THE

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THE

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TRANSFORMER PATENT LITIGATION IN AMERICA.

ONE sign of the growing importance of the electrical industry may be found in the fact that, both in this country and in America, a very large proportion of the patent cases in the law courts are concerned with patents for electrical inventions. The industry, in spite of its robust condition, is still unmatured, and the applications of some of the leading principles are still the subject of patent rights, so that among manufacturers it is a matter of great importance to possess, if possible, a "master patent" for machines now coming into general use; and it is equally important for other manufacturers to prove that their machines are not infringements of such patent, and that it, if valid at all, must be interpreted in a strictly limited sense. Thus to litigation of this character there attaches very considerable interest, not restricted to the litigants, but extending to all connected with the industry.

A year ago we described in our columns such a case, in which the Westinghouse Company in the United States sued the Saranac Electric Light Company upon the Stanley patent of March 1st, 1892, granted upon an application filed August 15th, 1888, and claimed that the transformers manufactured by the defendants were infringements of that patent. In this case the plaintiffs were successful, and the judgment in their favour not only upheld the validity of their patent, but seemed to go far towards making it a "master patent." Encouraged by this success, the owners of the patent promptly brought a fresh action against another company, and the decision of the Court of First Instance in this second case has very recently been given.

It will be remembered that Stanley in his patent laid down the principles to be followed in the construction of transformer coils, so as to avoid loss of energy in the primary circuit when the secondary circuit is open. He pointed out that the primary wire should be of such length that the counter electromotive force of self-induction should equal the electromotive force applied at the terminals of the primary winding; and he explained that he obtained this result in practice by first choosing the percentage of efficiency to be obtained and then applying such a length of primary winding that the difference of the applied and the counter-potential, multiplied by the current in the converter, should equal the predetermined loss of energy inevitable upon conversion. In the first case this "Stanley rule," as it was called, was much discussed. The Court held that it was "a part of the invention disclosed and claimed in the patent—indeed, it would seem to be the main object of that invention." In the second case, now decided, the discussion all centred upon the interpretation which ought to be placed upon the earlier decision; whether, or not, the Court had in that case imposed the limitation of the "Stanley rule" upon the claims of the patent then in litigation. The case

came on before Judge Colt in the Circuit Court of the United States, District of Massachusetts, and although we have not a full report of his decision, enough has been reported in the American technical journals, which recently arrived in this country, to enable us to learn how the matter now stands. We are not concerned with the defendants' machine; the real point of interest is the interpretation of the Stanley patent, and to that we confine our attention.

The plaintiffs contended that, although Stanley had to describe one method by which the proper length of wire was determined, his patent was held to cover the transformer described irrespective of the "rule" by which the length of wire is obtained, and that that decision made this patent a controlling or master patent. The defendants, on the other hand, maintained that it was clear from the former decision that the "Stanley rule" is inherent in his invention, and that his claims are limited by this rule. A peculiarity of the case is, that the plaintiffs maintained that in the Saranac case the transformer made by the defendants did not in fact embody the "Stanley rule," and that, therefore, the Court must hold that the transformer of the present defendants also came within the Stanley invention. The judge's finding on this contention is that it must be held that in the earlier case the defendants' transformer contained the Stanley rule; otherwise there would be the illogical conclusion that "on the question of validity, the Stanley patent is limited by the Stanley rule, while on the question of infringement, there is no limitation; in other words, a transformer may be outside of the monopoly secured by the patent and still infringe the patent." Judge Colt finds that the Stanley rule is the main contribution made to the art, and that it constitutes the most essential part of his invention. He disagreed with the plaintiffs' contention that it was Stanley's discovery of the proper length of wire which constituted his invention; or that the invention is for a transformer having a proper length of wire; or that the Stanley rule is no part of the invention claimed, but only one method of determining the length of the wire. In his opinion the Court expressly declared that the Stanley rule is the main part of the invention claimed; and limiting the claims by this rule, he has refused the motion for a preliminary injunction against the defendants.

We are without particulars of the transformer alleged in this case to infringe the Stanley patent, so it is a little difficult to follow these distinctions between the transformer without the Stanley rule, and one with that rule embodied in its construction; but it is evident that the effect of the decision is to put a much narrower interpretation upon the Stanley patent than was generally thought to have been made by the Court a year ago in the Saranac case. This is, no doubt, a matter of great importance in view of the large use of transformers to-day in systems of distribution. It will be remembered that an attempt was made in this country three years ago to prove that the Zipernowski-Deri patent for the connection of transformers in parallel across the primary mains was a master patent, but that the Court found that the patent was invalid.

Education at a Discount.

The article by Mr. Rankin Kennedy, which we publish on another page, deserves the close attention of manufacturers of electrical machinery; the views contained therein are in the main similar to those which we have ourselves expressed with regard to technical education. We believe that matters are mending in this respect, and that manufacturers are realising that a five or seven years' apprenticeship, of the old-fashioned type, is *not* the sole essential to the equipment of a capable engineer. This idea has held sway so long that its uprooting is a painful and tedious process; painful, by reason of the loss of business, and tedious because of the immense difficulty met with in opening the eyes of employers to the fact that their own training was not the best. One result of the last mentioned circumstance has been the foundation of numerous new concerns, well-equipped with enthusiastic and scientifically trained leaders, eager to seize upon the newest improvements and with minds free from the "set" resulting from many years of working in a groove. All this tends to the good of the industry; those who will not exert themselves to keep up with the race must be content to fall out, and to give place to better men, for the course of evolution cannot be stayed by prejudice and conceit.

Electricity on Main Line Railways.

In our issue of July 25th we published a summary of an article from an Italian paper on the trials which Mr. Huber, of the Oerlikon Company, is carrying out with a locomotive fitted with single-phase alternating current motors, with a view to applying this system to traction on main lines. The method of control with which he is experimenting is similar to that proposed by Messrs. Mordey and Jenkin in their paper before the Institution of Civil Engineers, which we dealt with in our issue of February 28th last. The single-phase system is at present being installed experimentally on a railway 20 miles long in America in Northern Michigan, and, at the same time, an American syndicate is taking up the Ganz system to push it in America. It will be very interesting to watch the results which will be obtained in Europe and America with these systems. The elaborate and costly experiments at Zossen do not seem as yet to have brought about any very great results, nor is it as yet contemplated to transform any main lines in Europe to electric traction. We see no reason, therefore, to change the opinion to which we gave expression in our leader on Messrs. Mordey and Jenkin's paper. The suggestion of operating long-distance lines is one which all who have any practical acquaintance with the subject know to be somewhat premature, and the directors of railway companies hesitate to consider electrical schemes for operating any portion of their main lines. The opinion which we have always held is that our railway companies should at once proceed with the electrification of their suburban lines in the neighbourhood of such large centres as London, Manchester, Liverpool, Glasgow, Newcastle, &c. In this connection it is interesting to note that the North-Eastern Railway Company appears to hold the same opinion, as it is at present calling for tenders to electrify some of its lines round Newcastle, and is going to spend nearly £100,000 on the experiment; power for operating the lines will be obtained from the existing power plants at Newcastle. This experimental line will probably be operated on the third-rail continuous-current multiple-unit system. The line under consideration is a loop extending from Newcastle Central *viâ* Wallsend, North Shields, Tynemouth, Backworth and Gosforth back to Newcastle Central, with a branch from Gosforth to Ponteland. The total length to be equipped consists of about two miles of four-track road, 35 miles of double track, and four miles of single track; and it is proposed at present to operate 50 motor coaches and 30 trailers, the trains being usually made up of two motor coaches with a trailer in the centre of the train.

We do not wish to retard progress, nor do we hold that

electric traction will never supersede steam locomotives on our main lines; but we do not think that this is likely to happen for some years to come, at any rate as far as this country is concerned, on account of the low price of good fuel and the absence of water-power. With the adoption of electric traction on our suburban lines the case is quite different, and within the next two or three years we expect to see electric trains running to Richmond and Wimbledon, and probably as far as Tilbury, in connection with the Metropolitan District and Metropolitan Railways. The competition of the County Council trams and the West London and other lines now running or under consideration will force our London railway companies to accommodate their systems to modern requirements, so as to meet the heavy, and what otherwise might prove disastrous, competition of the electric tramways. Some railways are alive to the necessity for action, and are taking steps to meet the case; for instance, the London, Brighton and South Coast has retained the services of Mr. Philip Dawson, who has so often written on this most important subject in these columns.

The fact that our American cousins are proposing to adopt the Ganz system on some of their lines does not cause us to alter our opinion in the slightest degree. We have every reason, after the most careful investigation, to be convinced of the soundness of our views, which although they do not agree with the ideas of some electricians, are those held by all who have had long experience with railways and heavy electrical traction.

The Rights of a Tenant for Life.

An interesting question arose in the case of *re* Blagrave's Settled Estates, which was recently heard by Mr. Justice Joyce in the Chancery Division, relating to the right of a tenant for life to expend money upon an electric lighting installation. As is well known, a tenant of property who has only a life interest cannot exercise the same powers or spend money upon improvements like an owner in fee simple. In the case under notice a tenant for life applied to the Court to be allowed to have sums paid out of capital for the purpose of improvements which included a complete electric lighting installation, and were made as the tenant alleged for the purpose of enabling the mansion house to be let. The installation included an engine room and an accumulator room, which formed an entirely new building; a petroleum engine; a dynamo and accumulators; cable connection with the mansion house, a switchboard and distributing fuseboard, branch circuit wiring, casing, branch switches, wall plugs, pendants, brackets and lamps. The total cost was £1,300. The Settled Land Act provides that authorised improvements include "any additions to, or alterations in, buildings reasonably necessary to enable the same to be let." In a previous case (*re* Clarke's Settled Estates, 86 L.T. Rep. 653) it was decided by Mr. Justice Buckley that wiring in houses could not be allowed. Following the principle of that decision, Mr. Joyce said that Mr. Justice Buckley had taken a very decided view on the question of electric lighting expenditure, and though of opinion that the view there taken was a somewhat narrow view of the Act, yet having regard to that decision and to the great importance of preserving uniformity in these matters, he did not see his way to come to a contrary conclusion. The cost of the engine room and accumulator room was accordingly allowed, but not that of other matters. We venture to think that if the principle which decided this case is reviewed in a higher Court, a different result may follow. No doubt an engine room and accumulator room would be of considerable value in enhancing the letting price of a dwelling house, but that letting value would be considerably increased by the completion of the instalment. In answer to the argument that wiring and fixtures are not improvements, it is sufficient to say that they are practically indestructible, and would increase the letting value for a number of years.

THE QUESTION OF THE "EARTHED" RETURN.

It was noticeable that the six papers presented to the Incorporated Municipal Electrical Association at its seventh convention were all of a technical rather than an economic nature.

It is well that the particular experience of each municipal engineer should be expressed in respect to double-current generators, steam engines of the turbine type, high-pressure continuous current systems, and other means and methods of generation, but in all such zealous recommendations we should not entirely lose sight of the main governing conditions—the commercial wants and requirements of the consuming public—from which alone the demand originates, and through which it is maintained and developed.

The paper ranging nearest to any consideration of the wants of the "consumer" was Mr. H. Faraday Proctor's "Notes *re* Earthing," but this was worded mainly from the station engineer's point of view, and was also unfortunate in coming next before Mr. J. F. C. Snell's paper on "Two and Three-Wire Distribution," which, labouring to make a favourable case for two-wire working, strongly criticised the earthing of the middle wire of a three-wire system. Any engineer wishing to support Mr. Proctor's suggestion as to the general advisability of earthing, would feel diffidence in so doing directly in face of Mr. Snell's recriminations.

The "earthing" question has now been before the electrical trade in a more or less acute form for a considerable period, and if the above papers had been read on separate occasions and each discussed from an all-round point of view, their consideration would perhaps have advanced us towards a definite solution. As we stand now, we are "no forrader." We had Mr. Trotter, of the Board of Trade, admitting that earthing practice as already adopted in Germany was very different to what was allowed here, and asking for the opinion of English station engineers as to whether they would remain satisfied to earth at one point of the system only. None of the station engineers present seemed willing to grasp the nettle firmly, or to create an interest in the question by pointing out how greatly the commercial possibilities of electricity supply could be enlarged if the consumer were allowed to adopt an uninsulated, "bare," or if it must be so called, an "earthed" return in house-wiring work.

Perhaps the supply station loads may be steadily increasing so that engineers consider that they have their hands full enough in meeting this growth; but are not some of them finding out that their expenditure on extensions is not gaining such a quick return as they anticipated? Could not the cost of their mains extensions be considerably reduced, if they boldly considered the possibility of entirely doing away with insulation on the neutral conductor of a three-wire system, or the negative of a two-wire system?

We think there can be little question that from the trades' and commercial point of view, "something" is immediately needed to give a renewed impetus to the electric lighting field. We believe this "something" to be an immediate development in and extension of the principle of "earthing" the return conductor.

Supply stations should begin to put themselves into a position to touch upon a new field of custom; the wealthier shopkeepers and householders have got their lighting installed, and the requirement to-day is to cater for the far larger and more uniform field of those who cannot afford a large initial expenditure upon wiring.

"Free wiring" and similar schemes have been introduced to meet these conditions, but such attempts are not proving a permanent success, and some means must be found to reduce the first cost of wiring.

The electrical contractor, in *his* field at least, due to competition in one form or another, finds work and profits steadily decreasing, and his very existence is becoming increasingly threatened and more difficult.

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It is not too much to say that the whole electrical supply trade is at this moment injuriously feeling the effect of the demand for cheap wiring, for there is an unwholesome cutting of prices insidiously arising amongst manufacturers of wires, conduits, switches, lampholders, and other necessary fittings, whilst the commercial standing and stability of the wiring contractors themselves are steadily lessening. These conditions are distinctly marked out by the attempts of all sets of interests to amalgamate amongst themselves, and form "associations" to provide mutual protection against this interminable "cutting" tendency.

To-day, wiring practice has developed to the use of *two* insulated wires installed under some form of mechanical protection—more or less perfect according to the material employed and the manner of its erection. Practical conditions controlling the variety of constructional methods have brought us to adopt some form of metallic "piping" or conduit.

Without discussing the relative values of the present systems of construction, it will not be disputed that the combined cost of labour with even the cheapest material, does, when using *two wires*, put electric wiring "out of court" in competition with the cost of a gas-fitting installation. The enlarged field for electricity supply that we now wish to enter upon can mainly be secured by the "pocket" consideration of the general public. Should we continue to supply an electricity consumer through two insulated wires enclosed in an iron pipe, in face of the handicap that gas is served through an iron pipe alone? With our present knowledge of earthed-outer "concentric wiring," and our increasing knowledge of "earthing" principles, can we not immediately save the expense of the insulation on *one* wire, and therefore decrease the size, and consequently the cost, of the enclosing pipe, and even do away with one wire entirely and employ a suitable jointed pipe in the double capacity of current carrier and protector?

If house wiring could be carried out with a single insulated conductor, enclosed within and protected by a suitable metallic armouring, which also served as the return (uninsulated) conductor, installation would be simplified in respect to labour and ease of construction quite as much as the first cost could be lowered.

We want a full discussion of the practice of "earthing," with a view to adopting the principle of saving the cost of insulating the return wire, and its adaptability to the main cable and distributing systems at present adopted by our supply stations. The possibility of introducing thereby new wiring methods which can at once combine safety, durability, and economy, might considerably influence that quicker commercial development which we all look and wait for. It is to be regretted that such a favourable opportunity for this discussion as the reading of Mr. Faraday Proctor's paper presented was not eagerly seized upon; however, Our columns are open to those who care to express their views on this important subject.

PARLIAMENTARY.

Mr. Seale-Hayne's Tube Committee.

Mr. Seale Hayne, as chairman of the House of Commons Committee which inquired into the Charing Cross, Euston, and Hampstead Railway Bills, has presented the following report of the Committee:—"That it is not intended that the railways should cross on the level any railway, tramway, tramroad, or highway. That, in accordance with the instruction of the House of July 18th, the Committee had inquired whether the railway proposed to be authorised by the Bill would seriously injure Hampstead Heath, under which it is to pass. Evidence has been adduced before the Committee by the promoters, and also on behalf of persons apprehending injury to the Heath, and the Committee were fully satisfied that the railway would be constructed at such a depth and in such a manner, that all risk of tapping the wells, draining the soil, or destroying the verdure would be obviated, and provision has been made in the Bill, as submitted to the Committee, prohibiting the promoters from interfering with any part of the surface of the Heath, and the Committee were of opinion that the powers sought by the Bill in relation to the said railway should be allowed. That reports from the Local Government Board had been referred to and considered by the Committee, but it appeared that amendments to give effect to the recommendations contained in such reports had been made in the Bills during their passage through the House of Lords. That a report from the Board of Agriculture with reference to the proposed utilisation of portions of the subsoil beneath Whitestone Pond and Hampstead Heath had also been referred to the Committee, but as already stated, it was proved to the Committee that no injury would be caused to the surface of the said common or commonable lands. That, by the Bill, it is proposed to authorise the payment of interest out of capital during the construction of the railway, but it was proved to the Committee that the power to pay interest would facilitate the raising of the capital authorised by the Bill, and the Committee having found that the restrictions contained in the Bill are in accordance with Standing Order 167, recommended that the payment of interest not exceeding 3 per cent., as proposed by the Bill, should be allowed. That there are no other circumstances of which, in the opinion of the Committee, it is desirable that the House should be informed." Mr. Seale-Hayne further reported from the Committee:—"That they had examined the allegations contained in the preamble of the Bill so consolidated, and amended the same so as to make it consistent with the provisions of the Bill as passed by the Committee, and found the preamble so consolidated and amended to be true, and had gone through the Bill and made amendments thereto."

Sir Lewis McIver's Tube Committee.

The Select Committee of the House of Commons, presided over by Sir Lewis McIver, resumed its deliberations on Wednesday of last week.

Mr. Balfour Browne, who appeared for the London United Electric Railway Company and the Piccadilly, City, and North-East London Railway Company, appealed to the Committee to say whether they intended to proceed with the consideration of those Bills now or in October. He would prefer that the Bill should be taken at once, and he believed they could be disposed of in the course of four or five days. The two Bills could be taken together, and if the Committee would sit on Saturday he thought they might be concluded this week.

Sir Ralph Littler, K.C., said he was afraid that four or five days would not be sufficient to consider two such important Bills.

The Chairman said that under the circumstances there was very little chance of finishing the Bills before the recess. The Committee thought it better not to commence their consideration now, but to postpone them until the House met in the autumn.

Mr. Balfour Browne asked leave to contradict a statement which he understood had been made. It had been stated in that room and in the Press that since leaving the House of Lords his clients had committed a breach of good faith and had raised their fares. He wished to say that such a statement was absolutely untrue. They had not raised a single fare, and he did not wish it to go forth to the public that they had done anything in breach of their obligations to the House of Lords.

Sir R. Littler said he had not made any suggestion as to the company having committed a breach of their obligations. He did state that the fares had been raised, and according to his instructions he would be able to make good that assertion.

Mr. Balfour Browne said he could only protest against such a statement, and when the proper time arrived he would be able to show the Committee that it was absolutely devoid of foundation.

The Chairman: We will take note of your denial. There is one matter we should like cleared up, and that is whether your attitude in offering no opposition to the Brompton and Piccadilly Circus Bill is to be taken as indicating anything like a further combine between the Yerkes and Morgan groups of Bills.

Mr. Balfour Browne said he was glad of the opportunity to state that he had nothing whatever to do with the Yerkes group, and if his attitude in the matter had led the Committee to imagine that he had, he wished to give it the most emphatic denial. As a matter of fact his clients were antagonistic to the Yerkes' promotions. They were deadly competitors to the District Railway Company, out of which Mr. Yerkes and his friends hoped to make all their money.

The Chairman intimated that Mr. Balfour Browne's Bills would be postponed until Parliament re-assembled in October.

Sir R. Littler then addressed the committee in reference to the point raised by them on the Brompton and Piccadilly Bill, as to the agreement referred to by Mr. Yerkes, under which the Traction Co. undertook to guarantee 4 per cent. on the capital of the four allied companies, the Brompton and Piccadilly Circus, the Great Northern and Strand, the Baker Street and Waterloo, and the Charing Cross, Euston and Hampstead. Considering the very short time at their disposal, there would be very great difficulty in scheduling that agreement to the Bill, as was desired by the Committee. In order, however, to get over the difficulty, and to meet the wish of the Committee, they had prepared the following clause, which would meet the case:—"The company shall lease their undertaking to the Traction Company, and the last-mentioned company shall take on lease or work the same upon a rent, or upon a guarantee of dividend of not less than 4 per cent. per annum on the amount of the debenture and share capital, but such power of leasing shall not be exercisable until a certificate has been obtained from the Board of Trade that the company have paid up one-half of the capital authorised to be raised by the Companies' Acts of 1897, 1899, and this Act, and expended for the purposes of such Acts a sum equal thereto, and that the Traction Company have paid up one-half of their share capital." They were perfectly ready to insert a similar clause in their other Bills.

Replying to Mr. Whiteley, Sir R. Littler said that any surplus profits over 4 per cent. would be divided between the Traction Company and the shareholders.

The Chairman said he thought the clause proposed by Sir R. Littler would meet their wishes. The Committee would like some further evidence on the financial aspect. They recognised that there was a solid £5,000,000 to be provided by the Underground Electric Railways Company, that could not be regarded as the capital of those undertakings, in so far that it was mortgaged for many purposes, but they looked on it as a very valuable asset. The one remaining practical point they wanted to have, either in binding form or attested in evidence by the parties, was the undertaking to place the stock.

Sir R. Littler said that, in consequence of the questions raised by the Committee, in reference to the financial proposals of the Bills, Messrs. Speyer Bros. had sent Mr. Yerkes a letter in the form of a sealed undertaking, in which they stated "that the Underground Electric Railways Company, which has entered into contracts to build the Brompton and Piccadilly Circus, the Great Northern and Strand, the Baker Street and Waterloo, and the Charing Cross, Euston and Hampstead Railways was formed under our auspices, and has a capital of £5,000,000, the whole of which has been subscribed at par by substantial persons well known to us. Thirty per cent. has been paid up in cash, and 10 per cent. is due on August 18th, the balance being available as it may be required. Parliament is asked to give capital powers in respect of these four undertakings of £3,844,000 debenture stock, and £11,536,000 ordinary stock. We have no hesitation in saying that, with these capitals at our command, we and our associates undertake to raise all the money necessary to complete the lines under discussion." He (Sir R. Littler) did not think the Committee would desire anything stronger than that, but he would call Mr. Edgar Speyer to speak as to the capabilities of the firm to find the money.

Mr. Edgar Speyer was then called. He said he was senior partner in the firm of Speyer Bros., of London, and he was also a partner in the firm of Messrs. Speyer & Co., of New York and Frankfurt. He and those associated with him were ready to undertake to furnish all the money necessary to build and equip the four underground electric railways referred to in their letter. They had satisfied themselves that the lines could be constructed on the estimates which had been put before the Committee. The estimates amounted to £15,000,000, but they had at their disposal £20,380,000, which gave them £5,000,000 as a reserve to be used in case of contingencies arising. His firm and those associated with them contemplated taking up and placing the whole of the stock and debentures, and he believed that the £15,000,000 would be subscribed by the public on the strength of the 4 per cent. guarantee.

The Chairman: We are quite willing to take Mr. Speyer's word in this matter. Your firm, Mr. Speyer, and your associates contemplate taking up and placing the whole of the shares and debentures of these undertakings?

The Witness: We do.

And Speyer Bros. mean to go through with it?—Yes, certainly we do.

Replying to Mr. G. Whiteley, the Witness said that if the public did not subscribe the £15,000,000 he and his friends would.

This concluded the case for the Bill, and after the Committee had consulted in private, the Chairman said the Committee had decided to find the preamble of the Bill proved on condition that the following clause was inserted:—"If, within 12 months from the framing of this Act, the company shall have failed to substantially commence the construction of their railway, and such failure shall be due to any cause within the control of the company, the powers of the company under or as extended by this Act shall, at the expiration of that period, cease and determine, and the certificate of the Board of Trade as to whether or not the said railway has been substantially commenced, or any failure to commence the same has been due to a cause within the control of the company, shall be final and binding."

Sir R. Littler, on behalf of the promoters, expressed his willingness to accept such a clause. The Committee then adjourned.

On Thursday of last week the Committee held a final sitting to consider and adjust the clauses of the Brompton and Piccadilly Circus Railway Bill.

Sir Ralph Littler, K.C., on behalf of the promoters, submitted a clause to carry out an agreement which had been entered into with the London United Electric Company with regard to the point at which the two companies' lines are to cross one another at the northern end of Sloane Street. The clause was to the effect that if the London United Company's Bill was sanctioned by Parliament the Brompton and Piccadilly Circus Company should not deviate their line to any greater extent than 3 ft. downwards from the level shown on the deposited plan at the point of crossing, and that a clear space of 5 feet should be left between the tunnels of the two companies.

The counsel decided to insert this clause in the Bill. They however refused to accept a clause under which the promoters wished to provide for joint stations in Piccadilly. They decided that each company should have separate stations, but that subways giving the public access to the opposite stations should be constructed at the joint expense of both companies.

Sir Douglas Fox was then called and explained on the plans an arrangement arrived at with the engineers of the London United Company, by which the promoters of the Brompton and Piccadilly Railway agreed not to deviate more than 10 feet in the construction of the new lines, or more than 15 feet in the authorised lines.

A clause to this effect was added to the Bill.

Mr. Atkins, as representing the London County Council, asked that the clause exempting railway buildings from the provisions of the Building Act should not apply in this case and the Committee acceded to the application.

Sir R. Littler called the attention of the Committee to the clause in the Bill dealing with workmen's tickets by which such tickets were not available for the return journey until after mid-day. He said that that clause had been inserted, because it was found that a large number of persons other than working men, tradesmen and others, used workmen's tickets in the early morning and returned sometimes at 9.30 o'clock when the trains were full. They wished to stop such a manifest abuse of the tickets. The workmen's tickets were only available on the day of issue.

Mr. Atkins said that the London County Council were agreeable to limit workmen's tickets to the day of issue, but they should be available to return by any train. If the clause was allowed in the form it now stood it would be the only one of the kind passed this session, and he submitted that the Committee ought not to accept it without very special reasons.

Sir A. Littler said that no *bonâ fide* workman would be injured by the clause, which he would remind the Committee was to be found in all the Bills of the old railway companies. The North London Company carried nearly 12 million workmen a year, and they had such a protective clause.

The Chairman said the Committee had decided to accept the clause as proposed by the promoters.

Mr. Atkins next asked for the insertion of a clause providing that the company should not commence the construction of any building on their scheduled lands without first giving notice to the London County Council of their intention to do so, and the company might at any time within three months require any part of such lands to be thrown into the public roadway and footway to such amount and on such terms as an arbitrator might decide. The clause further provided for the prohibition of the enclosing of any land which abutted on a public road and had been acquired by the company, but which they were unable to build on.

Mr. Fitzmaurice, the chief engineer of the County Council, gave evidence as to the necessity for this clause, if the Council were to take every opportunity that arose of making improvements with a view of increasing the value of the public thoroughfares. There were, he said, several of the sites which the company had acquired, where, in the opinion of the Council, it was desirable that street improvements should be made. One of those was at the point where Bow Street and Endell Street joined Long Acre, and the other was the alternative site for the proposed Long Acre station, at the corner of James Street.

Mr. Young, the chief valuer to the London County Council, gave similar evidence, and said it had long been the intention of the Council to carry out street improvements at the corner of Bow Street and Endell Street, Long Acre.

Sir R. Littler said the company were desirous of doing everything they possibly could to meet the wishes of the County Council, but if they were to construct the line at all, they could not possibly surrender the Endell Street site. On behalf of the promoters, he would agree to use the James Street site, and give an undertaking that they would make over to the County Council such land as they might require for street improvements on *pro rata* terms.

This was agreed to.

A request from the Cyclists' Union, asking for the insertion of a clause making it compulsory upon the company to provide accommodation for a certain number of bicycles, was refused by the Committee.

The remaining clauses were then adjusted, and the Bill as amended was ordered to be reported to the House for third reading.

City and Brixton Railway.—The City and Brixton Railway Bill which authorises that company to abandon certain authorised portions of their undertaking and to extend the time for compulsory purchase of land, &c., was before Earl Morley's Committee on Unopposed Bills on Wednesday last week, and was ordered to be reported to the House.

Electric Light Provisional Orders (No. 7) Bill.—This Bill, which confirms orders granted by the Board of Trade to the districts of Bedlingtonshire, Chepstow, Cowes, Hitchin, Morpeth and Ashington, Pokesdown, Slough, Stevenage, Tadcaster and district, Traefriw and West Riding, came before the chairman of Ways and Means in the House of Commons as an opposed measure on Tuesday last week, and the preamble having been formally proved, the Bill was ordered to be reported to the House.

Electric Light Provisional Orders (No. 8).—This measure was before the House of Commons Committee on Unopposed Bills on Wednesday, and the necessary proofs having been given, the Bill was ordered to go forward. It confirms electric lighting orders at Bermondsey and Rotherhithe, Stoke Newington and Woolwich.

Induction Coils for Automobiles.—What are our manufacturers of such appliances about, to permit English-made coils to acquire an unenviable reputation for lack of reliability? There is nothing experimental or mysterious about the manufacture of induction coils; the only new requirements are that they shall be waterproof, portable, and certain in operation. Surely these conditions can be met as readily in this country as abroad, and we hope that the present reproach will be speedily removed. We understand that the failure of the English coils to work well at high speed severely handicapped the Napier car, and was at the root of the breakdown of the Wolseley car in the race for the Gordon-Bennett Cup.

GLASGOW CORPORATION TRAMWAYS ACCOUNTS.

The accounts for the year ending May 31st, 1902, have just been issued in the form of a report to the Corporation. The principal items of revenue and expenditure are as follows:—

	1901—02.	Revenue per mile.	1900—01.	Revenue per mile.
Total receipts	£614,413	11·90d.	£489,469	11·82d.
Passengers carried ...	163,678,190		132,557,724	
Mileage	12,615,021		9,874,545	
Lines measured on single track	103½		88	
Average cars per day of 16 hours	365·41		322·02	
Expenses, including depreciation	£405,103	7·51d.	£401,839	
Gross balance	£209,310		£87,629	
Percentage of working expenses to gross receipts	65·93			

Power Expenses at Power Station and Sub-Stations.

	1901—02. £. s. d.	Per mile. d.	Per kw.-hour. d.
Salaries and wages ...	9,651 14 4	·194	·22
Fuel	7,952 14 10	·16	·18
Oil, waste and supplies ...	1,445 8 11	·03	·033
Water and gas	853 15 8	·017	·02
Disposal of ashes ...	207 11 3	·004	·005
Miscellaneous	110 8 7	·002	·002
	£20,221 13 7	·41	·46

Traffic Expenses.

	£ s. d.	Per mile.
Salaries	4,424 17 4	·089
Motormen, &c.	123,676 7 0	2·49
Cleaning cars, oil, &c. ...	39,942 8 10	·498
Accident insurance	5,967 11 0	·12
Miscellaneous	1,657 15 4	·033
	£160,668 18 6	3·23

Repair Expenses.

	£ s. d.	d.
Permanent way...	13,677 3 9	·28
Cars	16,479 8 5	·331
Other repairs to stations, uniforms, &c.	15,885 7 11	·319
Permanent way renewal fund at rate of £450 per mile of single track.	43,052 11 11	·87
Depreciation allowance ...	66,901 7 3	1·34
	£155,995 19 3	3·34

Net Revenue Account.

	1901—1902. £ s. d.	Per mile. d.
To Govan for lease of tramways	5,057 3 10	·096
„ Glasgow Corporation — interest on advances.	54,282 17 10	1·03
To sinking fund	36,974 15 9	·70
„ Glasgow common good ...	12,500 0 0	·24
„ General reserve fund ...	100,495 6 11	1·91
	£209,310 4 4	3·98

General Expenses.

	1901—1902. £ s. d.	Per mile. d.
Salaries and wages	5,461 9 10	·11
Taxes	15,298 8 10	·31
Property and income-tax ...	3,757 6 5	·075
Fire insurance	1,420 1 10	·03
Friendly society contributions	2,120 5 1	·042
Allowances to Reservists' dependents.	135 12 9	·003
Miscellaneous, including stationery and printing, auditor's fee, law expenses, rent of offices, Parliamentary and deputation expenses.	9,996 1 11	·2
	£38,189 6 8	·770

Capital Account.

	1901—1902. £ s. d.	1900—1901. £ s. d.
	2,041,035 19 0	1,793,934 8 1
Less depreciation and general reserve fund.	156,430 6 5	
Total amount borrowed ...	£1,884,605 12 7	
Unexhausted borrowing powers	201,885 18 7	
Net borrowing powers... ...	£2,086,491 11 2	

From the Committee's report it appears that everything is working satisfactorily. The main engines at Pinkston have now been tested, but the engineer's report has not yet been completed.

The International Exhibition of last year created a very large traffic.

The average length of the ½d. stage is slightly over ·58 mile. That of the 1d. stage is 2·32 miles.

A new type of fender is being gradually introduced on all cars to satisfy the Board of Trade, also a Newell electro-magnetic track brake.

Comparison cannot be made with this year's working, as last year's returns are mainly for horse haulage; but it would appear that the working expenses show a saving of 2d. per mile in favour of electricity.

There are still some miles of double track to be equipped under the 1901 Act.

The average total revenue per car-mile was 11·69d.

The average fare per passenger was ·90d.

The average number of passengers per car-mile 12·97.

Number of cars in stock 536.

Average expenses per car-mile, including depreciation, 7·71d.

LEGAL.

The Attorney-General *v.* the Bournemouth Corporation.

In the Court of Appeal on Tuesday, before Lords Justices Vaughan-Williams, Romer and Mathew, the case of the Attorney-General *v.* the Bournemouth Corporation was mentioned by Mr. Asquith, K.C. Learned counsel said the matter had been recently before their Lordships, and the question raised was whether the Corporation of Bournemouth had substantially commenced certain tramways within the period mentioned in the Act of Parliament. The Court decided that they had not, and granted an injunction restraining them from continuing to work the tramways or to construct those not yet completed. The Corporation had been advised to appeal from that decision, and were about to appeal, and the only question now before the Court was as to the terms on which matters could go on in the interim. One of the tramways had been actually completed and was at work, and obviously it would be a great public inconvenience if its operation was to be suspended until the result of the appeal to the House of Lords was made known. His learned friend, Mr. Warmington, K.C., appeared on the other side, and he did not think, subject to their Lordships' consent, that much difficulty would be raised in arranging terms by which the operation of the injunction would be suspended pending the appeal. Of course the appellants would undertake to prosecute the appeal with all reasonable dispatch.

Mr. Warmington said he was acting solely in the interests of the relators, the Poole Electric Construction Company, whose special interest was with respect of tramway No. 6. Their time, within which to construct that tramway, by Act of Parliament, commenced on August 2nd in that year, but obviously, it was not to the advantage of anybody that the same tramway should be twice constructed, and he suggested to his learned friend and he submitted to the Court, that as a term of suspending the operation of the injunction with regard to No. 6 tramway, they should undertake, if the injunction stood, to sell them that tramway at the cost of the construction of the permanent way, and of the overhead equipment. That would not do the defendants any harm, on the contrary, because if the decision of the Court of Appeal was upheld they would have to take up the line and it must be to the advantage of the ratepayers that instead of taking it up they were repaid the cost of construction.

Lord Justice Williams said that seemed a reasonable offer.

Mr. Warmington: We don't want to take their stations or any thing of the kind.

Lord Justice Romer said it would be an advantageous arrangement if the appeal failed.

Mr. Asquith said he did not think it an unreasonable offer, but he should like to mention this. The Corporation, as regarded the other tramways—for there were a number of others involved in this case—contemplated applying to Parliament to extend the time during which they could make them, so as to put right the defect which was made, and they did not wish their assent to any such undertaking as was now asked for to prejudice them in their application to Parliament.

Lord Justice Romer: It ought to be without prejudice to any Act of Parliament passed for that purpose.

Mr. Warmington said he rather objected to the motion that the Court recognised that their decision could be upset by Parliament. He did not think it would be regular and, indeed, it would really be depriving the plaintiffs of the benefit of the decision, for it might be represented to Parliament that their Lordships had really suspended their judgment. His learned friend could apply as much as he liked, but their Lordships' decision ought to be enforced.

Mr. Asquith said all he wanted to guard against was that if the Corporation were advised to go to Parliament, it might not be said, "Oh, you have given an undertaking to sell this tramway in the event of the House of Lords upholding the decision of the Court of Appeal to the relators, therefore you are not entitled to come here and ask for statutory sanction." That was all he wished to guard against.

Lord Justice Romer: Is there an injunction in this matter?

Mr. Warmington: Yes.

Lord Justice Romer: Why cannot you suspend the injunction until the hearing of the appeal to the House of Lords, leaving you to arrange terms?

Mr. Warmington: The danger to us is that our time is running, and we can do nothing. We have only got a year to construct, and if your Lordship's decision stands we are at liberty now at once to construct this tramway.

Lord Justice Romer: I don't know that the Court would be expressing any opinion by simply saying that the undertaking is to be without prejudice to any application to Parliament.

Mr. Asquith: It cannot possibly prejudice my learned friend.

Mr. Warmington: Your Lordship's remarks will be duly noted, and that, perhaps, will answer our purpose.

The Court then made the following order:—The operation of the injunction to be stayed pending the appeal to the House of Lords upon the appellants undertaking to give notice at once and prosecute with diligence their appeal; the defendants also undertaking that in the event of the House of Lords affirming the decision of the Court of Appeal, they will transfer to the relators the tramway No. 6 upon the terms of the plaintiffs paying to the defendants the reasonable cost of the construction of the permanent way and overhead equipment; in case of differences such cost to be settled by arbitration; the order to be without prejudice to any application in the meantime to Parliament by the defendants."

The Court directed the appellants to pay the costs of the application.

Wrigley *v.* the Windermere District Electricity Supply Company.

In the Chancery Division of the High Court of Justice on 2nd inst., Mr. Warrington, K.C., said that the case had been settled. The terms were simply that the action was withdrawn and the defendants pay the cost of the motion.

Electric Lamp Regenerating Company, Limited (Petition of Howard and Jones and Another).

This matter came before Mr. Justice Buckley in the Winding-Up Court on Tuesday. It appeared from the statement of Mr. Astbury, K.C., that this was a petition presented by creditors for the compulsory winding-up of the company, and no evidence was filed in opposition. Last week a Mr. Milne had given his personal undertaking to pay the debts of the petitioners, and of the creditors and the costs, and also the costs of the provisional liquidator, but that undertaking had not been carried out. Since the petition was presented, another petition was on the point of being filed, and the creditors agreed to release Mr. Milne from his undertaking.

His Lordship made a compulsory order.

BUSINESS NOTES.

Catalogues and Lists.—Messrs. Scott & Hodgson, Ltd., of Guide Bridge, have sent us two illustrated sheets showing some of their gearing work. One depicts a 17 ft. 3¼ in. diameter spur wheel, with cast-iron centre and steel rim, and forged pinion, 4 ft. 3¼ in. diameter. The other shows the cast-steel spur rim in one piece. Both of the wheels were cut by special machinery, capable of dealing with wheels of any diameter up to 26 ft., and both are 7 in. pitch × 30 in. wide.

Messrs. H. V. Kramer & Co. have issued a fully illustrated catalogue, divided into three sections:—(1) Electric drilling machines; (2) Transportable electric motor drills and accessories; (3) Electric machine tools. The pictures show the application of electric motors to a large variety of driving operations.

Messrs. Tangyes, Ltd., of Cornwall Works, Birmingham, have sent us a copy of their No. 50 catalogue, in which a large number of first-class illustrations of their hydraulic machinery are published, together with some neatly arranged descriptive matter.

Messrs. Joseph Adamson & Co., of Hyde, Cheshire, have issued a revised and enlarged edition of their pamphlet descriptive of modern electric travelling cranes. Numerous excellent photographic illustrations show engineering works and foundries in different parts of the country where Adamson's electric cranes are in use. Most crane users will be interested in the list, of which they can obtain a copy on application.

Messrs. Reiss & Martin, A. G., of Berlin, send us a well got-up catalogue of their machine tools, which include presses for hand or power, lathes, screw cutting and tapping machines, drills, shears, saws, &c., in great variety.

Electrical Catalogues Wanted. — Messrs. S. C. Farnham, Boyd & Co., Limited, engineers and ship builders, of Shanghai, China, having added an electrical department to their business, would be much obliged for catalogues and terms from manufacturers of and dealers in electrical supplies and accessories of every description.

Prize.—At the Tunbridge Wells show last week a First Prize, with Silver Medal, was awarded for Messrs. W. H. Willcox and Co.'s collection of Willcox semi-rotary patent double and quadruple-acting pumps, "Record" convertible pumps, patent wire-bound suction and delivery hose, Penberthy patent injectors, and their "X. L." ejectors, &c.

Electrical Wares Exported.

Week ending Aug. 6th, 1901.		Week ending Aug. 5th, 1902.	
Adelaide	Value £153	Alexandria	Value £158
,, Teleg. wire	220	Amsterdam	117
Alexandria	37	Antwerp	205
Amsterdam	60	Boca. Teleg. mat.	141
Bangkok	86	Bombay	94
Beira. Teleg. mat.	66	Boston	80
Bombay	122	Buenos Ayres. Teleg. mat.	80
Buenos Ayres	87	,, Teleph. mat.	699
,, Teleg. wire	296	Calcutta	710
Calcutta	153	,, Teleg. wire	462
,, Teleg. wire	100	Cape Town	269
Cape Town	1,081	Channel Islands	18
,, Teleg. mat.	332	Christchurch	68
Chinde	25	Colombo. 60 tons teleg. wire	—
Christiania. Teleg. wire	41	Copenhagen. Teleg. wire	192
Colombo	183	Durban	1,027
Copenhagen	3,158	,, Teleg. mat.	780
,, Teleg. cable	569	Fremantle	1,099
Durban	208	,, Teleg. mat.	2,215
East London. Teleg. mat.	2,618	Gothenburg	183
Gibraltar	13	,, Teleph. cable	410
Gothenburg	80	Halifax. Teleg. cable	934
Halifax	474	Hamburg. Teleg. mat.	20
Hamburg	83	Hong Kong	160
Hong Kong	30	Honolulu	20
Kobe. Teleg. cable	4,856	Lisbon	10
Labuan. Teleg. mat.	22	Madras	16
Madras	17	Nagasaki	67
Malaga	31	Odessa	156
Melbourne	800	Port Elizabeth	1,090
,, Teleg. mat.	464	Rio Grande	18
Moji	50	St. Petersburg	85
Montreal. Teleg. cable	48	,, Teleg. wire	44
Nagasaki	377	Santos	23
Ostend	55	Shanghai	51
Penang	60	Singapore	40
,, Teleg. cable	397	Stockholm. Elec. cable	20
Port Elizabeth	329	,, Teleph. cable	174
Quebec. Teleg. cable	3,301	Sydney	1,802
Rio Janeiro. Teleg. mat.	15	Vera Cruz	18
Santander	33	Wellington	162
Shanghai	120	Zanzibar	150
Stockholm. Teleg. wire	244		
,, Teleph. cable	630		
Sydney	486		
,, Teleg. wire	375		
Yokohama	3,518		
Total	£25,883	Total	£19,955

Foreign Goods Transhipped.

Antwerp. Elect. apparatus	Value £60	Cologne. Elec. instruments	Value £11
		Durban. Telephones	289
		Ghent. Elec. machinery	800
		Hamburg. Elec. light apparatus	83
Total	£60	Total	£1,183

Chloride Works.—The members of the Industrial Health Hygienic Section of the British Medical Association, at the combined invitation of the Chloride Electrical Storage Company, Limited, and Messrs. Pilkington's Tile and Pottery Company, Limited, Clifton Junction, near Manchester, visited the works of the two firms on Wednesday, 30th ult., for the purpose of inspecting them, and more particularly the provisions and preventatives employed for dealing with lead poisoning and the systems of periodical examination which are voluntarily adopted by both firms. The visitors, among whom were Dr. Whitelegge, H.M. Chief Inspector of Factories, Mr. Richmond, the superintendent inspector, Dr. Oliver, the Government expert, Dr. Glibert, Chief Medical Inspector of Factories of the Belgian Government, and Major E. M. Roe, Inspector of Factories, were entertained at lunch by the two firms at the works of the Chloride Company, between 50 and 60 members of the Section being present. The chair was taken by Dr. F. H. Bowman, of the Chloride Company, supported by Mr. Charles Pilkington, of the Pottery Company. After luncheon the respective works were inspected throughout under the guidance of Mr. Grindle on behalf of the Chloride Company, and the Messrs. Burton for the Pottery Company, the visitors manifesting a keen interest in all that they saw.

Birmingham Tramways.—In the Chancery Division of the High Court of Justice on Saturday, Mr. Thompson applied to Mr. Justice Joyce to sanction a petition to extend the memorandum of association of the Birmingham and Midland Tramways, Limited, which was formed to construct tramways in the neighbourhood of Birmingham. The company desired power to purchase, take, or lease, any land through or over part of which the company proposed to construct a tramway, power to generate and supply electricity for all public and private purposes, and to carry on business as electricians and electrical engineers or contractors. The learned counsel said that the power to supply electricity by tramway companies was now being taken in various parts of the country. Mr. Justice Joyce was satisfied the petition was reasonable and sanctioned it.

Electric Driving at Thornaby.—Messrs. W. Whitwell and Co., Limited, of Thornaby-on-Tees, are adopting electric driving for their works. Two generating sets of 250 H.P. each will be initially installed, whilst provision will be made in the engine house for a third. The engines will be of the Belliss quick-revolution type, and they will be coupled direct to Pieper multipolar compound-wound dynamos, working at a pressure of 240 volts. The whole of the six existing steam wharf cranes will be converted to electrical driving, and motors will be applied to straightening machines, shears, punch, and overhead traveller in the mills. In addition to this, the whole of the shops, comprising fitting, smiths', roll turners', and joiners' shops, will be driven, as will also the

testing machine, a slag stripping machine, a mortar mill, and power hammer. The whole of the lighting of the works, including blast furnaces and mills, will be done by means of 40 arc lamps and over 400 incandescents. We understand that Messrs. Warren, Beattie and Co., Limited, of Middlesbrough, have the whole of the contract in hand. Messrs. Warren, Beattie & Co. are sole agents for the North of England for the Pieper dynamos and motors.

Glasgow Infirmary.—In Glasgow Royal Infirmary last week a splendidly equipped electrical pavilion was inaugurated. The new building consists of four rooms, and the electric supply is procured from the mains of the Corporation. Three complete sets of Finsen's light apparatus for the treatment of lupus and other affections have been provided, and a special installation has been fitted up for the treatment of nervous ailments. The X-ray department has been refurnished, and the best apparatus for localising foreign substances in the body has been added. A large and powerful electro-magnet for extracting metallic material which has got into the body has been included, as well as electric drills, saws, trephines, &c.

London Electrical Contractors' Association.—At the general meeting held on Tuesday, July 29th, at Anderton's Hotel, Fleet Street, Mr. W. R. Woodward, the retiring President, delivered an address briefly touching upon the various matters which had engaged the attention of the Committee during the first year of the working of the Association, stating that the objects of the Association had been fully adhered to, and that several cases of dispute which had been brought forward by members had been satisfactorily adjusted. He also referred to the endeavours of the Institution of Electrical Engineers to establish a uniform standard specification, and briefly referred to negotiations which the Association had in progress with the Institution of Electrical Engineers and the Royal Institute of Architects as to the obtaining of goods for clients at preferential trade rates to the detriment of the electrical contractor carrying out installation work. He said that no further progress had been made with the National Manufacturers' Association, as they in turn were occupied with the endeavour to bring in the allied Manufacturers' Associations, viz., Plant and Cable, and within a short time it was hoped that the Manufacturers' Association would reply to the recommendations placed before them by the Contractors' Association. Workmen's certificates and municipal trading were also briefly referred to by the President, who informed the meeting that on account of the pressure brought to bear, the Glasgow Corporation had deleted the clauses in their Bill before Parliament, asking for powers to undertake installation work and other forms of electrical trading. Mr. Woodward also informed the meeting that evidence was being collected concerning other municipalities, and in the near future it was hoped to bring pressure to bear upon these municipalities with similarly successful results. In conclusion, he dwelt upon the fact that the whole of the contractors in the United Kingdom had been brought into line, and that this bond of union established by common interests was becoming closer, increasing in strength and effectiveness daily. Mr. Woodward then welcomed Mr. Rashleigh Phipps, the newly-elected President, to the presidential chair, expressing the conviction that the best possible choice had been made by the members in appointing him their new President, under whose guidance the Association was bound to increase in usefulness and to command the respect and attention of all branches of the electrical profession.—Mr. Rashleigh Phipps, who was received with applause, referred to the lack of interest shown by many members of the Association by their not being present at the meeting. He briefly outlined the points which should command the attention of the Association during the year, drawing attention to the probable serious results of trading by municipalities in competition with their own ratepayers, and also adverting to the want of good feeling which had hitherto existed between electrical contractors, and to the rapid breaking down of such impressions caused by the Association bringing home to the minds of members the unity of the objects of contractors for the common advancement of the trade. The President-elect also referred to what he regarded as the ideal consulting engineer, *i.e.*, the man who held the balance equally between his client and the contractor, and who did not attempt to secure advantages for the former at the expense of the contractor. Mr. Phipps also referred to a proposal for establishing a permanent committee to deal with all questions which might arise with manufacturers and consultants, which had the approval of the meeting.—Mr. E. L. Berry, at the invitation of the President-elect, contributed a short address, and recommended the Association not to attempt too much, but to go forward with one or two definite objects and secure those objects, thereby preventing the risk of attempting too much and accomplishing little. A discussion arose *re* the social side of the Association, and the probability of still further breaking down the prejudice which contractors have hitherto had against one another, and a recommendation was passed to the Committee to consider the possibility of arranging a monthly meeting of members, and an annual conversazione in addition to the banquet, or other social function calculated to bring members closely into touch.—Mr. W. Duncan submitted a curve which he had prepared from recent tendering of contractors, showing an extraordinary disparity in prices, with the result that invariably the successful tenderer, when the lowest tender was accepted and there was any great disparity in prices, was the contractor who had made a mistake in his price.

New Magazine.—*Business Illustrated* is the title of a new shilling "unconventional magazine review," being issued by the Bishopsgate Press, of 44—47, Bishopsgate Without, E.C.

Spain.—The electricity meter known as the "Nulcein," of the Compagnie Continentale pour la Fabrication des Compteurs à Gaz et autres Appareils, of Paris, has been officially approved for use in Spain.

ELECTRIC LIGHT AND POWER NOTES.

Birkdale.—On Friday last the new generating station of the Birkdale District Electric Supply Company was formally opened. A large number of officials and influential residents attended the opening ceremony. Mr. J. S. Raworth, M.I.E.E., chairman of the Birkdale District Electric Supply Company, Limited, addressed them briefly. The first step taken in connection with the establishment of the station, he said, was by the Birkdale District Council in 1898, when they obtained Parliamentary powers to carry out the work. They did not, however, exercise those powers, but in 1901 transferred them to the Birkdale District Electric Supply Company, with the approval of the B. of T. They had in the engine house three engines and dynamos of 110 KW. each, sufficient to enable them to burn about 3,500 lights.

The current was then switched on by Miss Weld Blundell, and the guests proceeded to inspect the machinery and battery room. They then adjourned to the Palace Hotel, Birkdale, where luncheon was served, Mr. J. S. Raworth presiding.

After the loyal toasts, the chairman proposed the toast of the "U.D.C. of Birkdale." Exactly 12 months that day, he said, they met to celebrate the opening of the Southport electric tramways, and 12 months before that they met to inaugurate the Southport tramways. His own experience of Southport went back much further. It was about 22 years since his first installation of the electric light in Southport. It was not a very large one: it was one of only one lamp, and that one lamp was far more interesting than any they had that day, because it was continually going out. The U.D.C. obtained the order in 1898 to instal the electric light, and when his company came along and said:—"You have got something that you don't know what to do with," and they said, "We have," the company said, "Very well: we are the men for you," and they had not great difficulty in making a bargain. The result was that within the short space of five months, the work had been accomplished, and the engines were running. He desired to record the thanks of the company to the engineer, Mr. Bentham, and to the contractors, Mr. Browett and Mr. Dursfield, for the admirable manner in which they had tried to meet the views of the company. They would charge 7d. for the first hour's use of the maximum demand per day, and 2d. per unit for all after that.

The toast was responded to by Mr. C. J. Weld Blundell, J.P., chairman of the District Council.

The toast of "The Birkdale District Electric Supply Company Limited," was submitted by Councillor J. Bentham, who said that, as a District Council, they had been asking a good deal, and the company had met them generously.

Councillor T. O. Clinning proposed the toast of "The Engineers and Contractors," paying a cordial tribute to Mr. Colebourne, and to Mr. Bentham, the resident engineer.

Mr. George Offor, in responding to the toast, said the contractors lived lives of anxiety, and the relief they enjoyed on an occasion like that was so great that he was justified in saying it was a red-letter day. They had carried out works of that kind in 20 towns in the United Kingdom, so the Council were not dealing with amateurs, but with a company who had had considerable experience. During the week it had been his duty to investigate the accounts of three of the towns they had been supplying, in one instance for two years. The price charged in those towns was identically the same as the price charged there—namely, 7d. and 2d. He had found that in those towns the price charged was not 4d. a unit, and in one case, in the town of High Barnet, that of a public house using the electric current for long hours, the cost during the winter quarter was 2½d. a unit, showing the working of the maximum demand system.

Mr. Thomas Browett also responded. It was, he said, a pleasure to work for the British Electric Traction Company, for they had the happy knack of spotting those points on the globe where money was to be made, and they might be quite sure the things they undertook were going to pay, for they had got to live by them. At present he was interested in electric traction in about 25 towns, and most of the companies knew that they had got to do the work on a sound commercial basis.

The proceedings thereupon came to a close.

The new generating station stands on a plot of sandy land abutting on Shaftesbury Road, Birkdale, 1¼ miles from the Lancashire and Yorkshire Railway station, Birkdale, and about 2¼ miles from the Southport station of the same railway. The work of erecting the station was begun on March 1st of the present year, and the station was opened on August 1st, so that the construction of the building and the installation of the machinery occupied exactly five months. The building is of a single storey, brick built with stone dressings, and, owing to the sandy nature of the ground, had to be erected on concrete. The engine house is 42 ft. long × 26 ft. wide, and has underlying it a bed of concrete 5 ft. in thickness. To increase the stability of the foundation for the engines, steel joists, 3 in. × 3 in., were laid at intervals as bonds. The generating machinery consists of three units, each comprising a dynamo of Messrs. D. Bruce Peebles & Co.'s manufacture, coupled direct to a Browett-Lindley two-crank, vertical, compound enclosed

engine. Each dynamo generates 110 kw. at 440 to 500 volts when running shunt wound at 450 revolutions per minute, and at 550 volts when compound. Each steam dynamo has a consumption of 30 lbs. of steam per kw.-hour when exhausting to the atmosphere, and of 25½ lbs. when condensing with a 26-in. vacuum. The engines exhaust through a 10-in. main fitted with Blake & Knowles' automatic atmospheric valves.

A set of balancers and boosters of Messrs. Bruce Peebles & Co.'s make, comprising four machines, on a common bedplate, has been installed.

The switchboard is 32 ft. long, and presents a striking appearance, being formed of 13 panels of white marble, 1¼ in. thick, mounted on a steel frame, with ornamental steel mouldings, and nothing of an inflammable nature has been used in the construction of the board. It has been supplied by the Konstructionswerke Electrische Apparate, and is arranged on the Bertram system. The main bus bars are mounted on insulators away from the board, all connections being made by means of copper strip. All of the instruments are of the Weston type, except the watt-hour-meters, which are of the Thomson type. At present there is only one tramway feeder, but a spare panel has been provided. Three lighting feeders are provided for on the switchboard.

At present about 20 miles of feeders and distributors are laid, and the whole network has been subjected to a pressure test of 2,000 volts alternating. The cable work has been carried out entirely by Callender's Cable and Construction Company. Three feeders have been laid, all of 0·2 sq. in. cross-section, concentric. The cables are insulated with vulcanised bitumen, and are laid in wood troughing filled in with bitumen, and covered with tiles. The distributors are of 0·075 sq. in. cross-section.

To relieve the main generating plant a battery has been installed, consisting of two sets of 135 cells each; 44 cells in each set are used for regulating. The batteries will give a normal steady discharge of 160 amperes for three hours or 65 amperes for 10 hours. The batteries are used for lighting only.

In the boiler house three Babcock & Wilcox water-tube boilers have been provided. Each boiler has 1,204 sq. ft. of heating surface, is fitted with a superheater having 142 sq. ft. of heating surface, and is capable of evaporating 4,000 lbs. of water per hour, at a pressure of 160 lbs. per sq. in. An induced draught plant has been fitted, for which a fan 100 in. in diameter is used, driven by a direct coupled steam engine, supplied by the Buffalo Forge Company. The fan may also be belt-driven by a 10-B H.P. motor of the Brush Company's make

The condensing plant is of W. H. Allen & Son's steam-driven surface type, and has a cooling surface of 1,100 sq. ft. The air pump and circulating pump are of Edwards' types, and are driven by a compound engine with cylinders of 9 in. and 14 in., and with a stroke of 8 in. The combined condensing plant is capable of dealing with 12,500 lbs. of steam per hour.

Two of Weir's vertical feed pumps, which will deliver 12,000 lbs. of water per hour against the boiler pressure, are used for feeding the boilers. The feed water passes through a Rankine feed-water filter, and then through a Berryman patent water heater, supplied by Messrs. J. Wright & Co.

In connection with the condensing plant a Koppel cooling tower has been erected; the tower stands on an area 35 ft. × 22 ft., and will deal with 48,000 gallons of water per hour, reducing the temperature from about 120° F. to 75° or 80° F. under usual atmospheric conditions.

To afford a reserve of water, a storage tank has been constructed above the boiler house, 45 ft. long × 11 ft. 3 in. × 3 ft. 9 in. deep, carried on four steel girders fixed in a vertical position.

The steam-pipe work was carried out by Messrs. Babcock and Wilcox. The main pipes supply direct to the engines, and the auxiliary steam range for the fan engine, pumps, &c., is arranged on the ring system. The steam pipes are of lap-welded steel. The feed pipes are also of steel, and are arranged on the ring principle. The exhaust and circulating pipes are of cast-iron. The whole of the steam valves have been supplied by Messrs. Templer and Ranoe.

The engine house is provided with an overhead "traveller," which has a lifting capacity of 10 tons, and is of Messrs. Morris and Bastert's make.

Current for lighting will be charged for at the rate of 13s. 4d. for any quantity up to 20 units in one quarter. For any quantity not exceeding the equivalent of 100 hours of supply at the maximum demand in any quarter the charge would be 7d. per unit, and for any further quantity at the rate of 2d. per unit.

The work of designing and erecting the power station was placed in the hands of the Electrical Power Distribution Company, Limited, of which Mr. J. J. Steinitz is chief engineer. The erection of the station was carried out under the supervision of Mr. Harold Bentham as resident engineer, now the managing engineer of the works. The architect for the building was Mr. M. H. Graham, of Newcastle-on-Tyne. The contractors for the steel superstructure of the building were Messrs. Duxfield Bros., of Southport. The steel for this work was supplied by Messrs. John Abbott & Co., of Gateshead-on-Tyne. The cost of the power house, machinery, cables and distributors, with necessary extras, has been about £30,000.

Amersham.—The R.D.C. has approved the application of the Uxbridge Electric Lighting Company for power to supply that parish and Chalfont St. Peter.

Austria.—The Austrian Schuckert Company, of Vienna, has applied for a concession to put down a plant to utilise the water-power of the River Feistritz at Freistadt, near Laibach, in the generation of electrical energy for lighting and power purposes.

Basingstoke.—The United Electric Light and Power Company intends to apply for a prov. order to supply electricity within the Council's area. At present it is the intention of the Council to carry out the works itself.

Belper.—The Derbyshire and Nottinghamshire Electric Power Company having obtained its Bill, has offered to supply the U.D.C. with electricity in bulk.

Bideford.—The Electric Supply Corporation, Limited, and the Electric Supply and Traction Company, Limited, have given notice of their intentions to apply for prov. orders for lighting Bideford with electric light.

Burslem.—As the T.C. proposes to establish a supply of electricity itself, it has decided to oppose the applications of the Potteries Electric Traction Company and of another syndicate for prov. orders to supply the borough.

Cheltenham.—The Town Council has a scheme for cable extensions to the outlying villages of Prestbury, Bishop's Cleeve, Leckhampton, Swindon, Southam, Brockhampton, and Woodmancote. The Prestbury Parish Council, however, is trying to drive a hard bargain in the matter of wayleaves.

Cults.—By way of experiment, a few of the houses in Cults were lit with the electric light last week for the first time since the end of March. It will be remembered that the electric plant, &c., was acquired from the liquidator of Messrs. Middleton and Co. by Messrs. Lowdon Bros. & Co., Dundee, who lost no time in getting the installation into proper order. New dynamos and extra boiler power have been put in, and the mains thoroughly repaired.

Darwen.—During the past year a gross profit was made on the Corporation electric light works of £2,374 9s. 4d., and a net profit of £126 17s. 8d. On the tramways there was a gross profit of £2,335 4s. 6½d., but after repaying loans, and allowing for sinking fund and interest charges, there is a loss of £963 16s. 7½d.

Dungannon (Co. Tyrone).—The U.D.C. is engaged in formulating a scheme for the electric lighting of the town.

Durham.—At the meeting of the Durham County Council on July 30th a committee was appointed to inquire into the question how far water-power could be utilised for a general scheme of electricity generation, and into the practicability of the scheme generally.

Egypt.—A limited company is about to be formed to take over and work a concession granted by the Egyptian Government for supplying electric light to Suez and Port Tewfik for 20 years.

Foot's Cray.—The ratepayers have passed a resolution approving of an agreement being entered into by the U.D.C. with either the Sidcup Urban Council or the Woolwich Borough Council for the supply of electricity in bulk.

Fraserburgh. — The Electric Supply Corporation, Limited, London, intends applying for powers for the electric lighting of the town.

Gerrard's Cross.—The P.C. has decided not to support the application of the Uxbridge Electric Light Company for power to supply the parish, as it might want to provide a supply itself. The Council, however, will not object to the company passing through a corner of the parish in order to supply Fulmer.

Gillingham.—The U.D.C., having decided to purchase so much of the undertaking of the Chatham, Rochester and District Electric Lighting Company, Limited, as lies within its district, Mr. M. K. North, L.G.B. inspector, has held a public inquiry relative to the application of the Council for leave to borrow £52,000 for the purposes of electric lighting and the purchase of the works mentioned. The population of Gillingham alone is now nearly 53,000, and the assessable value upwards of £105,000. Mr. Trentham, consulting engineer to the Council, had estimated that a profit balance of £400 a year would be made in the supply of electric light, &c., to the district by the Council. It was considered that the town was insufficiently lighted by the present system of the local gas company.

Glasgow.—It has been remitted to the chief electrical engineer, Mr. Chamen; the chief engineer for gas, Mr. Foulis; and the inspector of lighting, along with a small committee, to experiment with two streets lighted respectively with the latest Nernst incandescent electric lamp and the latest incandescent gas systems, with a view to the more economical and efficient lighting of the public streets. A deputation has received powers to visit any likely place for enlightenment.

Gold Coast.—An Anglo-African contemporary states that the question of electric power and lighting on the Gold Coast deserves the attention of capitalists. Sekondi offers an exceptionally good starting point, with a large demand already in existence.

Hanley.—The T.C. has received notice from the United Electric Light and Power Company, London, of its intention to make application for a prov. order to supply electricity within the Council's area.

Hebden Bridge.—The Electricity Committee of the U.D.C. has prepared a scheme for the establishment of works at an estimated cost of £18,000.

Heston—Isleworth.—The U.D.C. has received a report on electric lighting from Mr. Jas. Enright, who has been engaged to prepare plans and specifications for constructing an electric lighting station, and for mains, &c., for scheduled thoroughfares. The Council's surveyor, at the same time, was instructed to prepare plans for a dust destructor, to be constructed in duplicate, and worked in conjunction with the electric lighting station.

Honley.—The U.D.C. has received from the B. of T. consent for the use of overhead wires for the proposed electric supply for a period of five years. The Board adds that as a general rule the use of overhead wires is accompanied by many disadvantages, both as regards the safety of the public and the efficiency of supply, and it reserves to itself the right to require the undertakers to lay any portion underground at the end of five years, if at that time the exigencies of the district appear to the Board to demand it.

Horbury.—The U.D.C. has received notice from the Provincial Electric Supply and Traction Company of its intention to apply for a prov. order to supply electricity in the district.

Horsham.—At a meeting of the U.D.C. on July 31st, protests were made against employés at the electric light works being allowed to do private work in their spare time, to the detriment of the trade of the electricians of the town, and the matter was referred to the committee, who had sanctioned the practice, for consideration.

Ilford.—A loan of £31,718 for electric lighting has been sanctioned by the L.G.B.

Italy.—The engineer A. Barberis, and Signor F. Costa have applied to the Communal Administration of Asti for a concession for the construction of a hydro-electric power station on the Tanaro, with a view to supplying the town of Asti and the surrounding districts with electric light. The head of water will be 9½ metres, and the effective motive power at the turbine shaft will be 740 H.P. For public lighting purposes 400 H.P. will be placed at the disposition of the municipality at a price of 200 lire per H.P. per annum. The total cost of the installation is computed at 800,000 lire.

Kendal.—The Corporation commenced the supply of electric current for lighting last week. The standard pressure of the continuous current is 220 volts across each side of a three-wire system.

Kingston-on-Thames.—The T.C. has consented to allow the borough electrical engineer to advise the Teddington U.D.C. in regard to the tenders for electric lighting.

The Corporation has been informed that it is contrary to the bye-laws of the Institution of Electrical Engineers for the President to nominate three gentlemen, from whom the Council might select one for the purpose of advising the Council respecting various questions relating to the electricity undertaking. The Corporation has invited its members to select names and submit them at the next meeting.

Leyton.—The Great Eastern Railway Company having written to the U.D.C. in reference to the electric lighting of Leyton and Leytonstone stations, the Council has authorised the engineer to quote 4d. per unit as a level rate, upon the company guaranteeing a satisfactory minimum consumption.

London.—City.—In his annual report, Mr. A. A. Voysey, the electrical engineer to the Corporation, says that there are distinct evidences that a genuine competition is at present controlling the price of electric energy in the City. Both City undertakers now have the right to use the higher pressure. From the point of view of the public generally, the use of the higher pressure is advantageous, because the consequent decreased size of mains will result in less interference with the surface of the streets. The price charged to consumers last year stood at 4·45d. The number of consumers supplied on the last day of 1901 was 10,618, and there were 542,175 lamps connected. During the year 11,526,951 B. of T. units were sold, against 11,272,968 in 1900. As regards the public lighting, the total number of arc lamps on December 31st, 1901, was 508. The police reported 144 failures, and Mr. Voysey 133. Mr. Voysey looks on these figures as indicative of a great improvement in the continuity of the public arc lighting. The electrical engineer also refers to the supply of glow lamps for Corporation buildings, to explosions in street boxes, and to the conference of local authorities convened by the London County Council regarding their powers to purchase electrical undertakings.

Camberwell B.C.—The General Purposes Committee recently had a conference with the County of London and Brush Provincial Electric Lighting Company with respect to its proposal to sell its undertaking within the Council's area, and stated that the sum expended by the company was approximately £158,956. The company had laid about 25 miles of mains in the borough, and if the Council were willing to purchase the undertaking, they would now be prepared to treat on a basis many thousands of pounds lower than that provided in the purchase clause. It was decided that no action be taken in the matter.

Bermondsey.—The Electric Lighting Committee has decided to expend a sum of £4,185 in extending the system of arc lighting mainly in consequence of the numerous complaints of Hooligan outrages received by the Borough Council.

Woolwich.—The town clerk has reported to the M.B.C. that he has agreed to the insertion in the Woolwich order of the clause set out below, embodying a modification of a restriction sought to be imposed by the South Metropolitan Gas Company, who opposed both the Woolwich and the Bermondsey Orders:—

> The undertakers shall once in every year after the first year's working of the undertaking, cause to be laid before them a statement and balance-sheet of the accounts of the undertaking, drawn up in accordance with the form of accounts prescribed by the Board of Trade for a local authority, under the Electric Lighting Acts, 1882 and 1888, and the undertakers shall thereupon fix annually the charges to be made for the supply of energy in the then ensuing year at such rates (not exceeding the maximum rates specified in this Order), that as far as is reasonably practicable the revenue for that year shall not be less than the expenditure for that year.

Longton.—The T.C., before consenting to extend its electricity supply to manufactories outside the compulsory area, has decided to require from those applying for current an annual guarantee of £300 for three years, to be reduced by any consumption by persons other than the guarantors. The cost of extension is estimated at £1,606, and the promised consumption would yield £100 a year.

Lourenço Marques.—Electric light is shortly to be installed at this port by the Portuguese Government.

Lydd.—The South-Eastern Electric Light Supply Company intends to apply for a prov. order to supply electricity in the borough.

Middlesbrough.—The danger incurred in laying electric and gas mains in close proximity to each other is exemplified by the following excerpt from a report sent to the Gas Committee of the Corporation by one of the responsible officials:—"It was discovered that the 1½ in. new gas service into Messrs. Barclay & Co.'s Bank was allowing a great quantity of gas to escape into the premises. On examination we found a hole equal to a ¾ in. pipe had been fused by electric current from the Corporation electric supply. Our service was at once disconnected." The resident electrical engineer states that this is the only service laid near the gas pipes.

Newcastle-under-Lyme.—The T.C. has decided that plans and estimates for the adoption of an electrical scheme shall be prepared by a committee, in conjunction with the gas manager and the consulting engineer.

Salford.—In our issues of June 6th and 13th, we reported the inquiry which was held into the management of the Corporation electricity undertaking. Judge Parry has now issued his report thereupon. It covers 25 pages, and for the following summary of its contents we are indebted to the *Manchester Evening Chronicle*:—"His Honour replies to a long series of questions upon which he was asked to report. As to the Walness Road works, he is of opinion that the committee could not have done more or other than they did. They worked hard to obtain information, and acted on the best advice they could obtain, and the site they chose for the works was chosen after careful consideration and upon expert advice. From what he saw at the new works, and for the reasons given by the witnesses on the subject, it was clear that the Corporation had exercised a wise forethought in moving the works to the new site, and that they would have incurred a very large expenditure in trying to make the Walness Road site suitable, without any probability of ultimate success. On the question as to whether the total power provided was in excess of the requirements, and if so, who was responsible, his Honour states that the result has been to give Salford an electrical supply in excess of immediate needs, but if he were asked whether it would be in excess of future needs, he should refuse to prophesy. That must largely depend upon the energy and ability, or want of it, which the Corporation and their servants display in selling electricity to consumers. That the works were a credit to the borough and the result of an honest effort on the part of the committee and their servants to produce what was supposed to be requisite, he had no doubt. Dealing with several matters connected with the specifications, and with an attack made on Sir Richard Mottram and Galloways, Limited, who supplied the boilers for the works, and who had an interest in a tender for engines which was ultimately not accepted, the judge says he cannot see that anything wrong was done by Sir Richard Mottram in connection with the contract. He was further of opinion that no harm had been done to the ratepayers by deviation from the specifications, but he thought when there was any substantial alteration to be made in a contract, it should be reported by the engineer to the committee, and its effect explained at the time. With regard to trading, Mr. Hunt had laid down a principle that a councillor must not trade with another person who is doing trade with the Corporation. That was certainly not the law, and to his thinking it was not a sensible proposition to put forward. If the principle were sound, either trade would be paralysed or a municipal council must consist solely of those undesirables who have neither trade, occupation, business, nor profession, and therefore could not offend against Mr. Hunt's principle. A councillor was not fettered in carrying on his ordinary business in his ordinary way, or in trading with persons who traded with the Corporation. He may sell where he pleases, and that the person to whom he sells is a trader with his Corporation is of no importance. But he must not enter into a contract with his Corporation, nor must he take a portion of another man's contract with his Corporation, nor have any interest in such a contract. As to the costs, his Honour states that inasmuch as the parties to these complaints were obliged, out of courtesy to the Corporation and justice

to themselves, to appear at the inquiry which was held at the request and in the interests of the ratepayers, he thought the reasonable costs of the parties should be paid by the Corporation.

Bettwsycoed.—The Llanrwst Electric Supply Company intends to apply to the B. of T. for a prov. order for the electric lighting of the urban district.

Manchester.—The annual report of the Electricity Department of the Corporation shows that the number of consumers at the end of March was 4,030, of whom 237 were outside the city boundaries. The total number of lamps connected was:—Incandescent 307,067, and arc 2,453. In addition 774 motors were in use, representing 2,806 H.P. The total output of electricity from the works during the twelve months amounted to 12,697,590 units. The quantity measured and accounted for was 11,518,940 units, showing a difference of 1,178,650 units. The total mileage of mains was 209 miles 1,299 yards, and represented an increase of 50 miles 814 yards on the previous year.

The working of the department showed a gross profit of £60,407, and, after meeting interest, sinking fund charges, &c., a net profit of £7,634, which has been carried to the reserve fund. The advance of ½d. per unit in the price of energy realised £11,561.

The total borrowing powers now possessed by the committee amount to £2,171,121.

Nottingham.—An interesting operation, involving the demolition of the chimney of the electric lighting station in the Midland railway station, took place on Sunday afternoon. The railway station is being considerably enlarged, and the electrical works have already been re-erected further down the line. The "dropping" of the chimney, which was 130 ft. in height, measuring 18 ft. in diameter, and surmounted by an iron cap weighing 10 tons, was carried out under the supervision of Mr. E. M. Harding, of the Universal Engineering Company, Nottingham. Having cut away one of the faces of the base of the chimney the workmen removed the pigs at the side, and when the supporting corners had been partially removed the huge mass fell with a crash. The operation was rendered the more difficult by the fact that the chimney had only been built about five years and the base was constructed of hard blue bricks.

Peterborough.—The T.C. has decided to apply for a loan of £2,000 in connection with the extension of the electricity works.

Pontypool.—The electric light company has offered to the U.D.C. to enter into a seven years' contract for street lighting, and to substitute lamps for the present ones supplied by gas free of cost.

Radnorshire.—The County Council has decided to have the electric light installed in the County Asylum.

Rawmarsh.—The tramway company has agreed to pay the Urban Council £2,800, the cost of the Council obtaining electric light powers, in order that the company may be able to supply electric light in the town.

Redruth.—The principal streets of Redruth were lit by electric lamps for the first time on Friday evening last. The laying of cables and fixing of standards and globes during the week was a very smart piece of work. It was understood that the Urban Council, who had already extended the time one month from July 1st, would not grant further extension, but would insist on the fine of £40 per night being enforced unless light should be provided in the chief thoroughfares, and the contractors had to make a special effort. It was at Redruth that William Murdoch first applied coal gas to lighting purposes, and he used it in his house in Cross Street in 1792.

Rugby.—The U.D.C. has applied to the L.G.B. for sanction to borrow £9,000 for the purposes of electric light, and Mr. A. A. G. Malet was to hold an inquiry on Tuesday last.

Sidcup.—The U.D.C. has decided to approach the Woolwich B.C. and ascertain whether it would be prepared to supply energy to Sidcup, and if so, upon what terms.

Sierra Leone.—Mr. S. T. A. Buckle, of Free Town, has obtained a sole concession for electric lighting and electric tramways in that town for a period of 60 years. Mr. Buckle is the local magistrate, and the concession has received the formal approval of the Colonial Government.

South Shields.—In the *Local Government Chronicle* of July 46th an article appears commenting on the South Shields electrical undertaking. The article states:—"We take the case of South Shields as a type of the manner in which some local authorities have plunged into unnecessary liabilities, the extent of which is quite uncertain. The Corporation of that borough started their supply of electricity five or six years ago, and doubtless thought they were installing a most perfect and permanent system; but so rapid are the developments of science and its applications that it is probable that if the plant and mains had to be chosen to-day many of them would be of a very different character. . . . . In the particular case of South Shields the accounts are unsatisfactory and misleading, as important facts concerning the expenditure incurred and paid for out of the rates are not clearly shown in the official returns, and seem to have been suppressed. . . . . The supply was commenced in 1896. On March 31st, 1899, it appears that deficiencies to the extent of £5,114 3s 5d. had been contributed from the rates, and after deducting alleged surpluses there was still a net amount of £3,224 14s. 9d. against the ratepayers on March 31st, 1901. The accounts for another year have now been issued, and the trading can therefore be analysed down to March 31st, 1902. No provision has ever been made for depreciation, renewal, and antiquation of plant. If we deal with these items and (apart altogether from loss of value through the plant becoming old-fashioned and inefficient) merely charge 3 per cent. to cover depreciated value and renewals, the accounts will . . . . show an amount of £16,010, which must sooner or later be met by the ratepayers as the result of the speculation into which they have been led."

Spain.—The Spanish Government has granted a concession to a Bilbao firm to put down plant to utilise the water power of the river Ebro at Estrecha de Besantes (Burgos Provinces) in the generation of electrical energy for lighting and power purposes.

A central electric lighting station has just been completed and put in operation at Algar (province of Alicante). The plant, which is of 1,000 H.P. capacity, supplies current for the lighting of a number of small towns in the neighbourhood.

Sunderland.—At the last meeting of the Electricity Committee, the return for the half-year ending March last was submitted. This showed a net profit of £607 as against £1,900 as estimated. The decrease is attributed to several causes; primarily the increased cost of coal, which accounts for about £900; and also in a somewhat special degree to the increase in the payments required for interest and sinking fund in regard to the new generating station, which as yet, however, is making practically no return. It is estimated that the net profit for the September half-year will be £281. For the half-year ending March, 1903, it is anticipated there will be a deficit of £142, on an estimated revenue of £19,000. Generally the Committee are satisfied with the estimates, the decreases being consequent upon the developments which are being carried out.

Tipton.—The U.D.C. has decided to refer the dispute with the Electric Power Company as to the price to be charged for electric lighting to an arbitrator.

Wallasay.—Mr. W. H. Travers, engineer to the District Council, has suggested to the Gas and Electricity Committee that application should be made for sanction to borrow an additional £9,500 for further works and plant. The steadily increasing demand for electricity in the district, chiefly in the tramways department, has made the extension desirable.

West Bromwich.—The T.C. has received from the L.G.B. permission to borrow £10,000 for the extension of the electricity works.

Windlesham.—The Ascot Electricity Supply Company has sent details of its scheme for lighting this village to the Chertsey R.D.C. It is proposed to have a sub-station at Windlesham, which, with the mains, would be purchaseable by the local authority under the E.L. Acts.

Wirksworth.—The U.D.C., on Tuesday, referred to the Gas and Water Committee a communication from the Derby and Notts. Electric Power Company, with reference to obtaining a prov. order to supply the area of the Council.

ELECTRIC TRACTION NOTES.

Aberdeen.—The annual report just issued for the year ending May 31st, 1902, shows the following results of the tramway undertaking:—Total revenue, £37,931 17s. 9d.; working expenses, £26,577 1s. 7d.; balance, £11,354 16s. 2d.; receipts per car-mile, 13d.; expenses, 6d.

Aston.—The Corporation Tramway and Electric Light Committee has recommended the Town Council to adopt the overhead system of electric traction when the Corporation acquires the trams.

Auckland, N.Z.—The first shipment of electric cars for the Auckland Electric Tramway Company arrived from England by the *Niwaru* about the beginning of June last, and the remainder of the first consignment of 23 cars arrived by the *Waimate* on June 24th.

Barnsley.—The B.E.T. Company is applying to the B. of T. for extension of time for the completion of the works authorised by the Barnsley and District Light Railway Order, 1900.

Barrow.—The Corporation on Saturday signed an agreement with the B.E.T. Company for the construction of an electric tramway to the Docks, Roose and Furness Abbey. The Corporation reserves its right to purchase at the end of 7, 14, or 21 years.

Birkenhead.—The accounts for the year ended March 31st last show that the working of the tramways brought in a surplus of £3,514. The capital account includes an expenditure of £173,288 for tramways.

Bolton.—The T.C. has instructed the borough and electrical engineers to prepare an estimate of the cost of extending the electric tram service to Darcy Lever.

Bournemouth.—Last week a commencement was made with the line through the centre of the town, which is being constructed on the conduit system by Messrs. J. G. White & Co., Ltd.

Dover.—It is stated that in consequence of an accident at the electricity supply works on Tuesday, the municipal trams were at a standstill for over two hours.

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Southend-on-Sea.—Last week the Light Railway Commissioners held an inquiry into the application of the Corporation for further powers in connection with their electric tramway system. The existing tramways were inaugurated 12 months ago, and have been so successful that the authorities now ask for an extension to Southchurch and Shoeburyness, the latter by way of the Beach. There was considerable opposition to the proposals, the chief opponents being the L.T.S. Railway, whose managing director (Mr. A. L. Stride), in the course of the inquiry said that since the laying down of the present tramways last year, the passenger traffic between Leigh and Southend had decreased by 60 per cent. On the other hand, the town clerk (Mr. W. H. Snow) for the Corporation contended that the tramway would act as a "feeder" for the main line traffic of the railway in question. It was stated by the borough accountant that the estimated receipts from the present tramways had been put at £11,333 and they had actually been £11,312. The borough surveyor (Mr. A. Fidler) said the length of the new proposed railway, No. 1, would be 2 miles 7 furlongs 2·6 chains; and of the proposed new railway, No. 2, 6 furlongs 3·6 chains. The cost of both the railways had been estimated at £60,000. It was stated by the chairman of the Electric Lighting Committee that the present year would not see a profit of more than £50 as the expenses in compensation for accidents had been so heavy. The Essex County Council asked that if permission were given, the road to Southchurch be widened at the expense of the Corporation, to 60 ft. all the way along. Col. Boughey said the Commissioners' decision would be communicated in due course, but with regard to the opposition of the L.T.S. Railway, the arguments on both sides would be sent to the Board of Trade without any comment from the Commissioners.

Tilbury & Southend Railway.—At the meeting of this railway company last week Mr. H. D. Browne, the chairman, said that their Bill was then awaiting the Royal assent, but before doing anything towards applying electrical working on their railway, they proposed to await the result of the electrification of the Metropolitan and District Railways. The directors have, however, sent one of their staff to America to see what is being done there.

Walsall.—The lease of the borough electric tramway system to the Electric Traction Company expires next year, and at the present time opinion is divided as to whether the lease shall be renewed, or whether the Town Council shall take over the trams and municipalise them.

Wolverhampton.—On Tuesday the cars commenced to run along the whole of the Newhampton Road route to Tettenhall, so that there are now provided from the centre of the town two routes to this charming spot—one by Darlington Street and the other by Newhampton Road.

Wrexham.—The B. of T. has extended the time for the completion of the electric tramways from August 1st, 1902, to February 1st, 1903.

The T.C. has received a letter from the Wrexham and District Electric Tramways Company, Limited, stating its willingness to take a supply of electricity for the tramways from the Corporation works at a date not later than February 1st, 1903.

TELEGRAPH AND TELEPHONE NOTES.

Damages Against the National Telephone Company.—In the Nisi Prius Court at Liverpool Assizes, on Tuesday last week, before Mr. Justice Wills and a special jury, Messrs. Addison & Co., Limited, a firm of Blackpool merchants, sued the National Telephone Company and their contractor, Mr. J. A. Ewart, for damages for injury caused to their property by the negligent manner in which the excavations were made for laying a telephone cable along Church Street, Blackpool.

For the plaintiffs it was stated that, without giving any notice, the defendants laid bare the whole length of the foundations of the plaintiffs' property, and took no precautions to prop up or to protect the gable end of the house. Consequently, the windows cracked, and the gable wall sank; and plaintiffs contended that it would be necessary to rebuild the wall. This, with decorations, would cost from £400 to £450, while £50 was claimed as compensation for disturbance of business, and £100 for contingencies likely to arise in reconstructing an old building.

For the defence it was contended that a settlement had taken place in the building prior to the excavations, and that to effect the necessary repairs and provide for contingencies, £41 would be sufficient.

The Telephone Company pleaded that they were not liable, because they employed a contractor; and Mr. Ewart that he was not liable, because he did the work with all sufficient care.

The jury awarded the plaintiffs £250; and the contractor agreed to indemnify the Telephone Company in damages and costs payable to plaintiffs, on condition that the company paid its own costs.

Glasgow Corporation Telephone Accounts.—The first accounts of this department, dealing with the year ending May 31st, 1902, were issued on August 4th. The system was formally inaugurated on September 1st, 1901, so that the revenue is only for a period of nine months.

REVENUE AND EXPENDITURE.

Gross revenue from rentals for period September 1st, 1901, to May 31st, 1902			£25,854 2 4
Terminal fees from National Telephone Company per Postmaster-General			121 16 8
Sundry receipts			2,195 14 10
Total revenue			£28,171 18 5
Working expenditure			9,869 9 10
Net revenue			£18,302 3 6
Deductions—			
Interest on loans	£2,680 5 2		
Sinking fund	1,960 0 0		
Terminal fees to Nat. Tel. Co. per P.M.G.	846 9 1		
		5,486 14 3	
Balance			£12,815 9 3
Split as follows—			
Proportion of prepaid rentals for year 1902-3 carried to suspense account	£12,417 1 5		
Surplus for year 1901-2	398 7 10		
		£12,815 9 3	

BORROWING POWER.

By 1900 and 1902 Acts	£220,000 0 0
Deduct sinking fund as above	1,960 0 0
Net amount of borrowing powers, May 31st, 1902	£218,040 0 0
Amount borrrowed and not repaid, May 31st, 1902	172,240 0 0
Unexhausted borrowing powers	£45,800 0 0

The total capital expenditure to date amounts to £192,693 14s. 3d., but this includes a large amount of work in excess of present requirements, such as underground ducts, to avoid early re-opening of streets, also cables containing a large number of pairs of wires in excess of present requirements.

The following shows the estimate against what has actually been carried out:—

	Original scheme.	Actually executed.
Completed instruments provided	5,250	5,479
Partially completed lines	1,200	8,787
Switchboard accommodation	6,050 lines	7,060 lines
Mileage of pairs of wire in cable	4,938 miles	11,061 miles
Number of pairs of cable wires	6,450	14,572
Length of trenching	22 miles	94 miles
Capacity of pipes going out of exchange	6,900 pairs of wires	27,000 pairs of wires

The original scheme allowed for overhead construction, but it has been found on account of the large number of intending subscribers—1,700 still to connect—that it is best to keep underground as much as possible only using overhead work between the main cables line of route and outlying subscribers.

The number of local messages, counting a connection as one message, is now at the rate of 10,000,000 per annum. The average cost, therefore, of each message works out at ·62 of a penny. Counting a connection as two messages each message would work out as ·31 of a penny to each subscriber. There are 36 junctions to the G.P.O. and one line for transmission of telegrams by 'phone. There are 10 switch rooms in operation and seven about to be opened. The area tapped by the system covers 140 sq. miles.

Hastings Telephones.—It is stated that the Telephone Committee of the Corporation has just reported adversely on the scheme submitted by the expert whom it consulted.

Italian-Swiss Telephones.—The works of the Italian-Swiss telephonic lines are now near completion, and since the beginning of the present month the towns of Como, Chiasso and Lugano have been in active communication; during the first fortnight of August the Milan, Lugano, and Zurich will be in working order. By the 15th inst. it is hoped also to connect Genoa, Turin and Lyons. During next month communication between Rome and Turin, with French "correspondance," will be established. By the end of September the entire Rome—Voghera line, with extension to Milan, Genoa, and Turin, will be completed, with communication to French towns as far as the lines are available, as well as for interior inter-urban communication.

Italy.—A Continental correspondent says:—"At the end of the month Signor Marconi will return to Rome to establish contiguous to the town an important wireless telegraphy station, which it is understood will be provided with the most improved instruments, notably such as are calculated to increase the perceptibility of the receivers. The station will be established near the Italian capital, for it has been sufficiently demonstrated that the electrical waves are not affected by passage across land, even if the latter be hilly."

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South-Eastern Railway.—The half-yearly general meeting of this railway company was held last week, Mr. Cosmo Bonsor presiding. He said that there had been a great increase of receipts upon their passenger traffic. There was also a good increase in the number of first and second-class passengers, and for the first time for many years there was a decrease in the number of third-class passengers. This decrease was solely attributable to the competition of tubes and trams. The board had had before them the other forms of motive power—namely, electricity and oil. They watched with the greatest interest the improvements that were being made in the development of electricity for drawing trains, and as soon as they could see that it was applicable to any portion of their line they would ask the shareholders to adopt it.

Southend-on-Sea.—Last week the Light Railway Commissioners held an inquiry into the application of the Corporation for further powers in connection with their electric tramway system. The existing tramways were inaugurated 12 months ago, and have been so successful that the authorities now ask for an extension to Southchurch and Shoeburyness, the latter by way of the Beach. There was considerable opposition to the proposals, the chief opponents being the L.T.S. Railway, whose managing director (Mr. A. L. Stride), in the course of the inquiry said that since the laying down of the present tramways last year, the passenger traffic between Leigh and Southend had decreased by 60 per cent. On the other hand, the town clerk (Mr. W. H. Snow) for the Corporation contended that the tramway would act as a "feeder" for the main line traffic of the railway in question. It was stated by the borough accountant that the estimated receipts from the present tramways had been put at £11,333 and they had actually been £11,312. The borough surveyor (Mr. A. Fidler) said the length of the new proposed railway, No. 1, would be 2 miles 7 furlongs 2·6 chains; and of the proposed new railway, No. 2, 6 furlongs 3·6 chains. The cost of both the railways had been estimated at £60,000. It was stated by the chairman of the Electric Lighting Committee that the present year would not see a profit of more than £50 as the expenses in compensation for accidents had been so heavy. The Essex County Council asked that if permission were given, the road to Southchurch be widened at the expense of the Corporation, to 60 ft. all the way along. Col. Boughey said the Commissioners' decision would be communicated in due course, but with regard to the opposition of the L.T.S. Railway, the arguments on both sides would be sent to the Board of Trade without any comment from the Commissioners.

Tilbury & Southend Railway.—At the meeting of this railway company last week Mr. H. D. Browne, the chairman, said that their Bill was then awaiting the Royal assent, but before doing anything towards applying electrical working on their railway, they proposed to await the result of the electrification of the Metropolitan and District Railways. The directors have, however, sent one of their staff to America to see what is being done there.

Walsall.—The lease of the borough electric tramway system to the Electric Traction Company expires next year, and at the present time opinion is divided as to whether the lease shall be renewed, or whether the Town Council shall take over the trams and municipalise them.

Wolverhampton.—On Tuesday the cars commenced to run along the whole of the Newhampton Road route to Tettenhall, so that there are now provided from the centre of the town two routes to this charming spot—one by Darlington Street and the other by Newhampton Road.

Wrexham.—The B. of T. has extended the time for the completion of the electric tramways from August 1st, 1902, to February 1st, 1903.

The T.C. has received a letter from the Wrexham and District Electric Tramways Company, Limited, stating its willingness to take a supply of electricity for the tramways from the Corporation works at a date not later than February 1st, 1903.

TELEGRAPH AND TELEPHONE NOTES.

Damages Against the National Telephone Company.—In the Nisi Prius Court at Liverpool Assizes, on Tuesday last week, before Mr. Justice Wills and a special jury, Messrs. Addison & Co., Limited, a firm of Blackpool merchants, sued the National Telephone Company and their contractor, Mr. J. A. Ewart, for damages for injury caused to their property by the negligent manner in which the excavations were made for laying a telephone cable along Church Street, Blackpool.

For the plaintiffs it was stated that, without giving any notice, the defendants laid bare the whole length of the foundations of the plaintiffs' property, and took no precautions to prop up or to protect the gable end of the house. Consequently, the windows cracked, and the gable wall sank; and plaintiffs contended that it would be necessary to rebuild the wall. This, with decorations, would cost from £400 to £450, while £50 was claimed as compensation for disturbance of business, and £100 for contingencies likely to arise in reconstructing an old building.

For the defence it was contended that a settlement had taken place in the building prior to the excavations, and that to effect the necessary repairs and provide for contingencies, £41 would be sufficient.

The Telephone Company pleaded that they were not liable, because they employed a contractor; and Mr. Ewart that he was not liable, because he did the work with all sufficient care.

The jury awarded the plaintiffs £250; and the contractor agreed to indemnify the Telephone Company in damages and costs payable to plaintiffs, on condition that the company paid its own costs.

Glasgow Corporation Telephone Accounts.—The first accounts of this department, dealing with the year ending May 31st, 1902, were issued on August 4th. The system was formally inaugurated on September 1st, 1901, so that the revenue is only for a period of nine months.

Revenue and Expenditure.

Gross revenue from rentals for period September 1st, 1901, to May 31st, 1902			£25,854 2 4
Terminal fees from National Telephone Company per Postmaster-General			121 16 3
Sundry receipts			2,195 14 10
Total revenue			£28,171 13 5
Working expenditure			9,869 9 10
Net revenue			£18,302 3 6
Deductions—			
Interest on loans	£3,680 5 2		
Sinking fund	1,960 0 0		
Terminal fees to Nat. Tel. Co. per P.M.G.	846 9 1		
		5,486 14 3	
Balance			£12,815 9 3
Split as follows—			
Proportion of prepaid rentals for year 1902-3 carried to suspense account	£12,417 1 5		
Surplus for year 1901-2	398 7 10		
		£12,815 9 3	

Borrowing Power.

By 1900 and 1902 Acts	£220,000 0 0
Deduct sinking fund as above	1,960 0 0
Net amount of borrowing powers, May 31st, 1902	£218,040 0 0
Amount borrrowed and not repaid, May 31st, 1902	172,240 0 0
Unexhausted borrowing powers	£45,800 0 0

The total capital expenditure to date amounts to £192,693 14s. 3d., but this includes a large amount of work in excess of present requirements, such as underground ducts, to avoid early re-opening of streets, also cables containing a large number of pairs of wires in excess of present requirements.

The following shows the estimate against what has actually been carried out:—

	Original scheme.	Actually executed.
Completed instruments provided	5,250	5,479
Partially completed lines	1,200	2,787
Switchboard accommodation	6,050 lines	7,060 lines
Mileage of pairs of wire in cable	4,938 miles	11,061 miles
Number of pairs of cable wires	6,450	14,572
Length of trenching	22 miles	94 miles
Capacity of pipes going out of exchange	6,900 pairs of wires	27,000 pairs of wires

The original scheme allowed for overhead construction, but it has been found on account of the large number of intending subscribers—1,700 still to connect—that it is best to keep underground as much as possible only using overhead work between the main cables line of route and outlying subscribers.

The number of local messages, counting a connection as one message, is now at the rate of 10,000,000 per annum. The average cost, therefore, of each message works out at ·62 of a penny. Counting a connection as two messages each message would work out as ·31 of a penny to each subscriber. There are 36 junctions to the G.P.O. and one line for transmission of telegrams by 'phone. There are 10 switch rooms in operation and seven about to be opened. The area tapped by the system covers 140 sq. miles.

Hastings Telephones.—It is stated that the Telephone Committee of the Corporation has just reported adversely on the scheme submitted by the expert whom it consulted.

Italian-Swiss Telephones.—The works of the Italian-Swiss telephonic lines are now near completion, and since the beginning of the present month the towns of Como, Chiasso and Lugano have been in active communication; during the first fortnight of August the Milan, Lugano, and Zurich will be in working order. By the 15th inst. it is hoped also to connect Genoa, Turin and Lyons. During next month communication between Rome and Turin, with French "correspondance," will be established. By the end of September the entire Rome—Voghera line, with extension to Milan, Genoa, and Turin, will be completed, with communication to French towns as far as the lines are available, as well as for interior inter-urban communication.

Italy.—A Continental correspondent says:—"At the end of the month Signor Marconi will return to Rome to establish contiguous to the town an important wireless telegraphy station, which it is understood will be provided with the most improved instruments, notably such as are calculated to increase the perceptibility of the receivers. The station will be established near the Italian capital, for it has been sufficiently demonstrated that the electrical waves are not affected by passage across land, even if the latter be hilly."

Telegraphic Rates to West Africa.—On July 30th the Imperial Telegraph Committee of the House of Commons received a deputation from the Liverpool and London Chambers of Commerce with reference to the action necessary to get a reduction of the present tariff to West Africa. Sir Edward Sassoon, M.P. presided.

Telegraphic Interruptions and Repairs :—

Cables.	Interrupted.	Repaired.
Latakia-Cyprus	June 20, 1899 ..	..
Communication with Carthagena and Barranquilla (Columbia)	Dec. 8, 1900 ..	..
Trinidad-Demerara No. 1	Aug. 27, 1901 ..	..
Communication with Bolama	April 18, 1902 ..	..
St. Lucia-St. Vincent	May 8, 1902 ..	..
St. Lucia-Grenada	May 8, 1902 ..	..
Dominica-Martinique	May 8, 1902 ..	..
St. Lucia-Martinique	May 8, 1902 ..	..
Guadeloupe-Martinique	May 9, 1902 ..	..
Santa Cruz de Teneriffe to Tejita de Teneriffe	July 4, 1902 ..	..
Puerto Plata-Martinique	July 10, 1902 ..	..
Anjer-Kalianda	Aug. 2, 1902 ..	..
Guantanamo-Mole St. Nicholas	Aug. 5, 1902 ..	..
Nagasaki-Fusan (between Tsushima and Fusan)	Aug. 5, 1902 ..	..
Landlines :—		
Route *via* Hanekin on Persian territory	Feb. 24, 1900 ..	..
Communication with Tientsin and Taku *via* Helampo	July 18, 1900 ..	..

Telegraphs in Turkey.—The Turkish Government has, it is announced, decided to establish a telegraph line between Tripoli and Fezzan.

Telephony in Italy.—The firm of Siemens & Halske is at present making experiments in long-distance telephony. The secretary of the Italian Postal and Telegraph Department, Signor Di Pirro, has been deputed by the Minister of Posts and Telegraphs to assist at the experiments in question.

Wireless Telegraphy.—On the Cunard steamships fitted with wireless telegraphic apparatus, the Marconi Telegraph Company charge a uniform rate of 6d. per word for telegraphing from the ships to a Marconi station or to a passing ship, and the extent to which the system is used for private messages is stated to be 2,000 words from one ship in a single passage.

CONTRACTS OPEN AND CLOSED.

OPEN.

Accrington.—August 19th. Nine arc lamps and pillars for street lighting. See "Official Notices" to-day.

Amsterdam.—September 8th. Underground high pressure and low pressure cable system (three-phase, direct and telephone). See "Official Notices" July 4th.

Austria.—August 25th. The Austrian State Railways Administration, Pilsen, require supplies of arc and incandescent lamps and cables for lighting purposes. Offers should be received before August 25th.

Belgium.—August 11th. The Provincial Government Authorities at Liège are inviting tenders until August 11th, for the construction and working of an electric tramway between Seraing and Val St. Lamberts. Particulars may be obtained from, and tenders are to be sent to, Le Gouvernement Provincial, Liège.

Bexley.—August 9th. Cables, switchboards, battery, booster, rotary converter and motors, for electric lighting and traction. See "Official Notices" July 25th.

Bristol.—September 10th. Electric wiring, bells, telephones; also boilers, economisers, piping, &c., for the Guardians' Infirmary. See "Official Notices" to-day.

Burnley.—August 12th. Two or five mechanical stokers for the Electricity Committee. See "Official Notices" to-day.

Christiania.—September 13th. Sealed tenders marked "Telegrafog-Telefonmateriel" will be received at the Board of Managers' Office, Christiania, up to 3 p.m. on the 13th prox., for the supply to the Norwegian State Railways of the undermentioned goods:—22,000 kilogs. of telegraph wire, No. 8, galvanised iron wire, 4·1 to 4·3 millimetres diameter; 5,400 kilogs. of telegraph wire, No. 11, galvanised iron wire, 3·1 to 3·3 millimetres diameter; 3,600 kilogs. of copper wire, 2·4 to 2·6 millimetres diameter; 5,900 porcelain insulators; 5,900 insulator holders. Tenders may include part or all of the goods required. Further particulars can be obtained on application to the office of the Inspector of Telegraphs, Stoners Gade, Christiania.

Dresden.—October 1st. A competition for a safety apparatus in connection with the working of electric tramways will be decided on the date mentioned by the Communal Administration of the town of Dresden (Saxony). Three prizes of 5,000, 3,000 and 2,000 marks will be awarded.

France.—August 20th. Tenders are being invited until the 20th inst. by the French Post and Telegraph authorities in Paris for the supply of 300 tons of copper-wire in six lots. Tenders are to be sent to Le Sous-Secretariat d'Etat des Postes et des Telegraphes, Rue de Grenelle 103, Paris, whence particulars may be obtained.

Harrogate.—August 18th. Electric wiring at the Kursaal for the Corporation. See "Official Notices" to-day.

Ilford.—August 19th. Combined watering and sweeping car with equipment. See "Official Notices" July 25th.

Kala Lumpur (Selangor State).—August 21st. Two 600-H.P. turbines, two 400-KW. three-phase generators, switchboard, motor-generators, poles, wire, &c., for transmission line, arc and glow lamps, &c., for the Crown Agents for the Colonies. See "Official Notices" July 11th.

King William's Town (Cape Colony).—September 1st. Sealed tenders for electric lighting plant, &c., as per specifications, will be received at the office of the King Electric Lighting and Cold Storage Company, Limited, King William's Town, Cape Colony, until noon on Monday, September 1st, 1902.

Launceston (Tasmania).—September 15th. The Corporation wants tenders for polyphase generating, transmitting, transforming and distributing apparatus, reconstructing existing plant, enclosed arc lamps, &c. See "Official Notices" May 23rd.

Leicester.—September 3rd. Tram rails, points, crossings, conduits, cables, overhead equipment, bonding, boilers, engines, generators, and other power station plant; also electric cars for the Corporation. See "Official Notices" July 18th.

Malvern.—August 23rd. Lancashire boilers, engines, alternators, cables, transformers, switchboard, &c., for the Council's electricity supply scheme. See "Official Notices" July 11th.

Manchester.—August 11th. Erection of a sub-station at Newton Heath. Apply City Architect, Town Hall.

N.E. Railway.—October 7th. The directors are inviting tenders for the complete electrification of about 37 miles of standard gauge (double track mostly) line in the neighbourhood of Newcastle. The contract is divided into two sections—(1) electrical equipment of coaches and permanent way; (2) high-tension cables and sub-station equipment. For further particulars see our "Official Notices" July 25th.

Newport.—August 20th. Electric generating plant and wiring, &c., for the new lunatic asylum at Caerleon. See "Official Notices" July 25th.

Northfleet.—The U.D.C. is desirous of entering into a contract with some company for the working of its electric lighting order. See "Official Notices" July 25th.

Pemberton.—August 20th. Complete electrical installation (boilers, engines, dynamos, &c.), cables, rails, &c., and overhead equipment. See "Official Notices" August 1st.

Roumania.—September 3rd. The municipal administration of Calarasi-Stirbey (Roumania) is prepared to receive tenders for the concession of establishing and working the electric lighting service of the town.

Rugby.—August 20th. One 150-KW. and one 60-KW. high speed steam three-phase alternators; switchboard, mains, lamps, and meters for the U.D.C. See "Official Notices" August 1st.

Servia.—August 13th. Tenders are being invited until August 13th by the municipal authorities of Nisch for the establishment of a central station for the electric lighting of the town.

Spain.—August 10th. The municipal authorities of Trujillo are inviting tenders until August 10th for the concession for the electric lighting of the town during a period of 20 years. Particulars may be obtained from, and tenders are to be sent to, El Secretario del Ayuntamiento de Trujillo.

St. Petersburg.—August 14th. Conduits for the municipal telephone system. See "Official Notices" July 25th.

Valparaiso.—September 1st. Construction and equipment of electric tramways. Further particulars from the Chilian Consulate.

Wolverhampton.—August 13th. Complete electric light installation for new union workhouse. See "Official Notices" July 25th.

Youghal Asylum (Co. Cork).—August 12th. Steam dynamos, battery, switchboards, wires and fittings. Particulars from Mr. H. A. Cutler, Municipal Buildings, Cork.

CLOSED.

Bradford.—The Conditioning House Committee has accepted the tenders of Messrs. Collinson Bros., of Bradford, for the electrical equipment of a new conditioning house.

Brighton.—The Corporation has placed a contract for a storage battery for tramway work with the E.P.S. Co.

Dewsbury.—The tender of the Klein Engineering Company for a cooling tower at the electricity works has been accepted by the Electricity Committee.

Halifax.—The Electricity Committee has accepted the tender of the United Asbestos Company, Limited, for covering the boilers and steam pipes at the electricity works with asbestos composition, at 7d. per square foot; also the tender of Messrs. Reavell & Co., Limited, Ipswich, for the supply of an air compressor.

Rochdale.—The Tramways Committee has ordered three additional tramcars from Messrs. Dick, Kerr & Co., Limited.

Sheffield.—Messrs. Cole, Marchent & Morley have secured the order for the 1,000-KW. engine and generator for this city, making the fourth of their engines on order for the Sheffield Council, or in all 3,000 KW. normal output. In our last issue we mentioned the firm's address as "Sheffield." This, of course, was a mistake, as the address is Prospect Foundry, Bradford.

We understand that Messrs. Askham Bros. & Wilson, Limited, have received a good order from the Sheffield Corporation for their toughened crucible cast-steel points and crossings.

Tokio: Imperial Japanese Navy.—We learn that the contract for the motor equipment of the Tokio Imperial Dock Yards has been secured by Messrs. D. Bruce Peebles & Co. There will be installed about 200 motors, varying from 5 to 40-B.H.P.

Tunbridge Wells.—The T.C. has accepted the tender of the Alphons Custodis Chimney Construction Company, Sheffield, for the erection of a chimney shaft, 180 ft. high, at the central lighting station, for £2,330.

Wolverhampton.—The Tramways Committee has accepted the tender of Messrs. Dick, Kerr & Co. (£735) for a track cleaner.

NOTES.

Stampings for Electrical Purposes.—We have received from Messrs. Joseph Sankey and Sons a catalogue which is, we believe, absolutely unique in the annals of the electrical industry. This remarkable production measures 20 in. × 30 in. × ¾ in., and weighs over 14 lbs.; it is fitted with a substantial brass handle. The catalogue deals with insulation, end-plates, segments, and complete rings, and gives particulars of the permeability and hysteresis of the material used ("Lohys" brand) &c. The most striking feature is the immense variety of tools at the disposal of the firm. Plain tools for stamping out rounds are duly tabulated, tools for centre holes and keyways combined, tools for stamping disc centres and ventilating spaces at one operation, tools for punching armature stampings complete, &c. Every stamping that is known to the electrical trade is duly set forth, either *in full size or half size scale drawings*. The book must be of immense importance to the English trade, and will greatly assist in standardising. The Committee of the Institution of Electrical Engineers who are dealing with the standardisation of designs will probably find this catalogue of interest in their investigations. There are no fewer than 80 sizes of segment tools shown in full scale drawings; this is really an innovation, and resembles nothing of the kind we have seen or heard of before. The drawings are in deep blue on a white ground, are well executed, and contain all the necessary particulars relating to each tool or stamping. The catalogue is purely technical and of use only to works engaged in the manufacture of dynamos, motors and transformers. We are glad to see such energy and enterprise in this branch of the electrical industry, and we congratulate Messrs. Sankey and Sons (who are represented by Mr. Robert Jenkins, of 88, Bishopsgate Street Within, London, E.C.) on their unique production.

British Electrical Manufacturing Enterprise.—From a notice which we publish in our "City Notes" to-day, it will be seen that an important change is being brought about in the well-known Preston concern with which Messrs. Dick, Kerr & Co. have been identified right from its initiation two or three years ago. There is every reason to believe that with their increased capital and under the altered conditions, Messrs. Dick, Kerr & Co. will be in an even stronger position than before. The enterprise which has been displayed by this company during the past few years has given great satisfaction in most electrical circles, and more especially among engineers who have been eager to see our national electrical industrial position improved so as to enable foreign competitors to be successfully beaten by British manufacturers. Our readers will have noted from what has appeared in our columns during the past year or so, how actively the firm's representatives have been engaged in the Colonies, and if what they have done in the past may be regarded—as we believe it may—as an indication of what they are likely to do now that Colonial development, especially in South Africa, is about to take a leap forward, Preston manufactures will be very much in demand. They have secured a very firm footing in pretty well all important parts of the British Colonies and Dependencies. In the Far East they are supplying machinery for Hong Kong; in Canada the firm has a branch whose prospects are very bright; contracts have been booked recently in South America; India is also being nursed, and only last week we had occasion to mention the excellent order obtained by them in the face of the keenest American competition, for the Sydney electric lighting plant. Turning more particularly to South Africa, it should be mentioned that notwithstanding the war, Messrs. Dick, Kerr & Co. have been engaged upon the equipment of the Camp's Bay and Cape Town tramways; have supplied the new generating plant and rolling stock for the Cape electric tramways; and have furnished the complete generating plant for the Durban Corporation tramways. They are busy with electric plant equipments for several mining companies, and, we understand, have just made arrangements for vigorously meeting the business which is now coming on in the Rand district. One point of special interest, which we must not overlook, is the steps they are now taking for developing lines of alternating machinery which will enable them to cope with American and German competition in this branch of manufacture.

The English Electric Manufacturing Company, Limited, has been greatly helped by having the services of Prof. S. H. Short, who has been able, upon the basis of his previous American experience, to obtain results in the design of traction motors and generators which are distinctly in advance of what American makers have been able to arrive at. Prof. Kennedy's report to the London County Council may be quoted as an example in this connection. We understand that there has been no scrap-heap at Preston, and if that be so, Prof. Short is entitled to a great deal of credit when one considers the rush and magnitude of the work there. In discussing the question of American competition, we think it right to draw attention to the unfairness arising from the fact that, though British manufacturers may adequately equip themselves for competition throughout the civilised world, they are debarred from the United States of America by a prohibitory tariff, which, we believe, is 45 per cent. It is easy to see the advantage which this gives to American electrical firms, in reserving for them the largest market in the world, whilst, at the same time, they are free to meet on equal terms British firms in Great Britain, where it is exceedingly difficult to obtain any appreciation of this discrimination. Fortunately, the Colonies show a greater understanding of the vital facts of the case.

Through Traffic on Tramways.—We are glad to notice that Mr. J. E. Waller has opened the question of through traffic for passengers and goods on tramways, in a paper read before the Liverpool Chamber of Commerce. The subject is important for various reasons. First, if the through traffic for goods especially be looked on as a coming necessity, the importance of uniform gauge for tramways will be perceived. As regards passenger through traffic, it is undoubtedly a fact that a good system of tramways, that will pick up a passenger practically at any time, and carry him from near his own door to some point not far from his place of business, will have the advantage over the infrequent train with its arbitrarily placed termini, arbitrary, that is, as regards most of the passengers. Few suburban passengers in a city like London are well placed for both termini. A man lives near to the suburban station of one company and has his office near that of another company. The managers of the respective companies do not seem to possess the intelligence or the consideration to afford facilities for the public to travel to and fro on either line. Why should a season ticket holder from Victoria not be allowed to travel on any company's line out of the two stations at Victoria, to any suburban station near his home? These matters do not interest the railway management, because they would be useful to the public who need not be considered. We all remember the late chairman of the S.E.R., who excused the list of maimed passengers on his line, in an accident outside Cannon Street Station, on the grounds that they were decently dressed people who were hurt, and they ought not to be travelling third class, even, we suppose, to avoid S.E. frowsy firsts.

Mr. Waller points out that to get by train from Chawbent to Liverpool occupies an average time of two hours, with two and sometimes three changes *en route*, and even this can only be done at seven fixed times daily. The distance is 26 miles by rail, and 24 by road, for which three hours should suffice, and the author thinks that with a tramway service, the hour would probably be saved by the passenger's ability to start when he wished and return when convenient. The railway fare is 1s. 11d. return, while the fare of the Lancashire Light Railways will not exceed 1s. 3d. to any part of Liverpool. He points out that the South Lancashire Tramways, now constructing, will connect up directly with systems aggregating 400 miles, on which facilities for interchange, not only of passengers, but also of goods, ought to be afforded. Goods traffic has yet to come to the tramways. One result of municipal tramways has been to make them little local affairs, on which at most a few parcels could be carried. Municipal narrow views have refused to recognise the possibility of traffic beyond the borough boundary. This view of tramways will have to disappear. In the pamphlet before us, the possibilities of goods traffic are pointed out, and details are considered in the shape of suitable wagons for the purpose.

Those who know Lancashire are well aware of the enormous local traffic done by carts. The Heaton Mersey Bleach Works, for example, six miles outside Manchester, are kept supplied with goods to be bleached, entirely by huge horse wagons, and this is simply a single case out of many hundreds of others where it would be possible to utilise a tramway.

Electric Plant for Rand Mines.—The *British and South African Gazette* says: "The enormous improvement which has taken place in recent years in everything relating to electrical machinery, has not left the great mining companies on the Rand unaffected, and whereas seven or eight years ago none of the mines were able to provide themselves, except at prohibitive cost, with their own power, and were consequently compelled to be tributary to an outside institution like that of the Rand Central Electric Works at Brakpan, large numbers of them now are not only able to and do supply themselves, but upon much more economical and favourable terms than from an outside source. The consequence of this is a large increase in the demand for electrical material of all kinds, which is constantly being added to as each mine makes a

further extension of its establishment, or a revision of its plant. This transformation of old plants was especially active during the enforced period of idleness after the annexation, some mines, like the May Consolidated, merely limiting their reconstruction works to displacing the numerous small steam engines used to drive separate items of their plant by electric motors, still drawing their supply of current from the Brakpan Works, while others set up complete generating plants outright. According to latest reports, 10 mines are still tributary for current to the Rand Central Works, which also supplies a number of chemical and industrial establishments and a part of the demands of Johannesburg and the railway, its aggregate contracts totalling 2,400 H.P. With the new mines coming into working, or opening up, and with the prospective municipal tramway and lighting scheme, very large calls for electrical material will be made, and Home firms are advised to bestir themselves accordingly."

Electrical Standardising, Testing and Training Institution.—As a result of the recent scholarship examinations, the Board of Control of this Institution have made the following awards:—

To Mr. Herbert Stanley Phillips, of Oakham School, Oakham, Rutland, an exhibition of the value of 30 guineas, tenable for two years.
To Mr. John Nelson Nayler, of Kingswood School, Bath, a prize of 20 guineas.

Personal.—Mr. E. Parkinson, chief inspector of the Bradford City Tramways, who has received an appointment under the South Lancashire Tramways Company, was last week the recipient of presentations from the management and clerical staff, and from the drivers and conductors, in token of their appreciation of his work among them in Bradford. The presentations were made by Mr. C. J. Spencer, the manager of the Bradford Tramways.

Fire Prevention Exhibition.—The British Fire Prevention Committee is assisting in the organisation of a thoroughly representative international fire exhibition on technical lines, to be held at Earl's Court from May to October, 1903. Those who are interested in this very worthy project can obtain circulars giving full particulars as to classes of exhibits from the acting secretary, British Fire Prevention Committee, 1, Waterloo Place, London, S.W. There are, of course, departments for electrical safeguards and electric alarm calls.

Cleaning Boiler Tubes.—The cleaning of boiler tubes inside and the appliances for doing so have been discussed recently by the *Revue de Mécanique*. Though a thin scale is probably less harmful and of better heat-conducting power than generally supposed, any really thick scale must seriously diminish the capacity of a boiler. Probably the effect of scale is less apparent than it otherwise would be because the tube area is considerable, and when some tubes fall below their maximum capacity others begin to do more work. To clean a tube when much curved is perhaps not very easy, but straight tubes should be easily bored out. Probably even a small bent tube could be bored out by means of a suitable boring-head and a flexible shaft. A straight tube should easily be bored out, and in an electric works with current at hand it should be a simple matter to bore out a boiler tube by means of a rapidly rotating cutter-head electrically driven, the head being cooled by a good stream of water, which will also serve the purpose of washing away the *débris*. It is surmised by our contemporary that it would be found as cheap to prevent scale as to remove it, a view with which general agreement may be expressed. The outside cleaning of tubes can be effected by steam jets or air jets. These will remove dust and loose soot, but will not remove tenacious soot resulting from bad combustion, a sort of sticky tar such as it is usual to burn off economiser pipes by running the gases through without water in the pipes. The cleaning of tubes inside by means of acid is disputed. By some it is thought that the acid will not touch the metal so long as any scale remains to be dissolved; others hold a contrary view. We are inclined to think the acid method is safe, but should welcome some tests that might well be instituted by the boiler insurance companies upon boilers about to be removed from work, or immediately upon removal, so that some definite and precise knowledge might be gained on the subject. Flue dust does not appear to adhere to vertical tubes, though soot will, and the use of scrapers seems almost universal in economisers. The economiser may, however, be worked satisfactorily without scrapers where the furnace arrangements are such that no smoke is made.

Metric Weights and Measures.—An important report was issued recently by the Decimal Association, showing the progress made since the issue of the last report in February, 1901. Numerous Consular Reports are cited, to show that the need of reform is urgent; the Russian Government has taken steps in the direction of adopting the metric system, the United States, the Commonwealth of Australia, and leading men in Canada and South Africa, have passed resolutions strongly in its favour, while the Convocation of London University, the Associated Chambers of Commerce and others regard the compulsory adoption of the metric system as imperatively necessary in the interests of our trade. No fewer than 266 members of Parliament have expressed their approval of the movement, an increase of 95 since 1901. The question appears to be drawing to a head; if we do not take the first step, the United States will do so, and then we shall be compelled to follow suit—just as they will follow us, if we take the initiative, as we should. Probably important progress will be derived from the Conference of Colonial Premiers. A sudden change of any kind is contrary to the established customs of the British people; but the adoption of the metric system, say, in two years time, as a compulsory measure, is of the first importance, and deserves the earnest support of everyone who is interested in the maintenance of our foreign trade.

Accident on Newcastle Tramways.—A serious accident occurred on Wednesday afternoon on the Newcastle trolley lines. The trolley wheel of a fully loaded car which was ascending a steep incline up Westgate Hill suddenly left the wire, and as the rails were wet and greasy the brakes refused to act. The car ran backwards and collided with another full car which was also ascending the hill. A number of persons were injured, some of them seriously.

Appointment Vacant.—Assistant engineer for Edinburgh Electricity Works, at £100.

THE CENTRAL STATION ENGINEER.

Mr. J. G. Griffin, of Burnley, has been appointed resident electrical engineer and tramways manager at Swindon, at a salary of £250.

Mr. Leonard Andrews has placed his resignation as Corporation electrical engineer at Hastings in the hands of the Lighting Committee. It is understood that it is contemplated to retain his services as consulting engineer.

The Bolton T.C. has appointed Mr. Wood as station superintendent at the electrical works at a salary of £140 per annum.

On 1st inst., Mr. C. D. Taite, borough electrical engineer, presented Mr. J. Williams, engineer-in-charge, on behalf of the staff, with a silver-mounted dressing-bag and other articles, upon the occasion of his leaving Salford to take up an appointment under the Sheffield Corporation. Mr. Taite spoke highly of Mr. Williams's ability and his long period of service, he having been engineer-in-charge at the opening of the first generating station at Salford seven years ago.

Mr. A. D. Constable, lately testing engineer at the Croydon Corporation Electricity Works, was on Thursday, July 30th, presented with a gold-mounted fountain pen, a set of folding combination compasses, and a smoker's cabinet, the occasion being his departure to take up the position of chief assistant to the Chatham and District Light Railways Company. Mr. Gray Scott, in making the presentation, referred to Mr. Constable's valuable services, and the regret that all felt at losing him; a most hearty send-off terminating in the usual way with musical honours.

Mr. R. Mackay, assistant mains superintendent at the Croydon Corporation Electricity Works, will shortly be leaving to take up a similar appointment with the British Westinghouse Company.

Mr. A. Pickersgill, assistant electrical engineer to the Dewsbury Corporation, has been appointed engineer to the Cleckheaton U.D.C. There were over 100 applicants for the position.

The Canterbury T.C. has increased the salary of the first assistant engineer at the electric light works, Mr. F. A. Lewis, from £2 to £2 7s. 6d. per week.

Mr. G. E. Heath, assistant electrical engineer at York, has been appointed electrical engineer at Erith.

NEW COMPANIES REGISTERED.

Minehead Electric Supply Company, Limited.—(74,382). This company was registered on July 18th, with a capital of £2,000 in £1 shares, to carry on in Somerset or elsewhere, the business of electricians, providers of electricity, suppliers of light, heat, power, traction, and sound, manufacturers of, and dealers in, and with cables, wires, lines, accumulators, meters, generators, distributors, posts, insulators, fittings, lamps and the like, electrical and mechanical engineers, &c. The first subscribers (each with one share) are:—J. R. Davis, solicitor, Minehead, Somerset; Mrs. M. S. Davis, Minehead, Somerset; J. Boddy, baker, &c., Minehead, Somerset; Mrs. L. Boddy, Minehead, Somerset; Mary Mowatt, manageress of Hotel Metropole, Minehead, Somerset; Miss G. Mowatt, Hotel Metropole, Minehead; and Mrs. L. Leather, Minehead. No initial public issue. The number of directors is not to be less than two nor more than seven; the subscribers are to appoint the first; qualification, £50.

East Anglian Engineering Company, Limited (74,407).—This company was registered on July 22nd, with a capital of £10,000 in £1 shares, to take over the business carried on as Stowmarket and elsewhere by the Anglian Engineering Company, Limited, to adopt an agreement between F. C. Peecock of the first part, H. W. Wilson of the second part, and F. Taylor, for this company, of the third part, and to carry on the business of consulting, mechanical, and electrical engineers, manufacturers of cycles, motor cars and carriages, wire drawers, tube makers, &c. The first subscribers (each with one share) are:—F. C. Peecock, Stowmarket, solicitor; H. W. Wilson, Stowmarket, engineer; P. C. N. Peddar, Stowmarket, land agent; H. Mase, King's Lynn, electrical engineer; S. A. Mow, Needham Market, bank manager; H. N. Prentice, Stowmarket, engineer; and E. M. Crosse, Stowmarket, engineer. No initial public issue. The number of directors is not to be less than three nor more than seven; the first are F. Taylor, H. Mase, and H. W. Wilson; qualification, £500.

D. Santoni & Co., Limited (74,406).—This company was registered on July 22nd, with a capital of £2,000 in £1 shares, to take over the business of importers and exporters of economic, domestic, scientific, curative and pastime electric appliances, dealers in international novelties and electrical goods and accessories, &c., carried on by D. Santoni, at 22, Goswell Road, E.C. The first subscribers (each with one share) are:—E. Durien, 87, Elgin Crescent, W.; H. A. Welte, 55, Hunter Street, W.C., clerk; J. Law, 78, Albert Street, N.W., secretary; J. H. Macdonald, 177, Cavendish Road, Balham, S.W., clerk; V. Bornand, Winchester House, Victoria Square, Birmingham, electrical engineer; C. C. MacCarthy, 14, Swinbourne Grove, Manchester, electrical engineer; and K. Fiedler, 90, Chiswell Street, E.C., merchant. Minimum cash subscription 10 per cent. of the shares first offered to the public; provided that not less than 1,000 shall be so offered. The number of directors is not to be less than two nor more than seven the first are D. Santoni and V. Bornand.

Sheppey Water and Lighting Company, Limited (74,364).—This company was registered on July 16th, with a capital of £12,000 in £1 shares, to supply the Island of Sheppey, and especially the parishes of Minster and Eastchurch, or other places in Kent, with water and electric light and electricity, and to carry on the business of waterworks proprietors, electricians, electrical and mechanical engineers, gas makers and suppliers, &c. The first subscribers (each with one share) are:—F. F. Ramuz, J.P., Shorefield, Southend, land agent; G. H. Wills, 62, Park Road, Sittingbourne, retired brick manufacturer; L. Seager, London Road, Sittingbourne, contractor; M. Pierson, 72, High Street, Sheerness, farmer; J. R. Bligh, Eastchurch, Sheppey, contractor; W. A. Benson, C.E., Brambledown, Minster; and G. F. Ramuz, 68, Cheapside, E.C., auctioneer. Minimum cash subscription 25 per cent. of the shares first offered to the public. The number of directors is not to be less than five nor more than seven; the first are W. A. Benson, G. H. Wills, F. F. Ramuz, J.P., L. Seager, M. Pierson, J. R. Bligh and G. F. Ramuz; qualification, £100; remuneration, £50 per annum, divisible. Registered office, 4, Edward Street, Sheerness, Sheppey, Kent.

David Moseley & Sons, Limited (74,437).—This company was registered on July 24th, with a capital of £300,000 in £10 shares (14,000 preference), to acquire the business of india-rubber manufacturers and merchants carried on by D. Moseley, J. F. Moseley and O. G. Moseley, as "David Moseley and Sons," at Manchester, London, Glasgow, Birmingham, Sydney and elsewhere, and to carry on the business of manufacturers of, and wholesale and retail dealers in, articles and goods made wholly or partly of india-rubber or other gum, carriers by land and water, shipowners, warehousemen, wharfingers, constructors of railways, tramways, gas and electric works and other works and conveniences, &c. The subscribers (each with one share) are:—D. Moseley, Chapelfield Works, Chapelfield Lane, Ardwick, Manchester, manufacturer; J. F. Moseley, Chapelfield Works, Chapelfield Lane, Ardwick, Manchester, manufacturer; O. G. Moseley, Chapelfield Works, Chapelfield Lane, Ardwick, Manchester, manufacturer; Mrs. R. Moseley, Cringle Hall, Levenshulme; Miss L. Moseley, Cringle Hall, Levenshulme; Miss M. M. Moseley, Cringle Hall, Levenshulme; and Mrs. B. Allen, The Cedars, Heaton-Mersey, Lancs. No initial public issue. The number of directors is not to be less than three, nor more than five; the first are D. Moseley, J. F. Moseley and O. G. Moseley (all permanent governing directors); qualification, £10,000; remuneration of governing directors £5,000 per annum, divisible. Registered office, Chapelfield Works, Chapelfield Lane, Ardwick, Manchester.

Concordia Electric Wire Company, Limited (74,416).—This company was registered on July 23rd, with a capital of £2,000 in £1 shares, to acquire any inventions relating to the production of light, heat, sound, power or other effects by electricity or otherwise, or to the generation, use, storage, accumulation, measurement, distribution and transmission of electricity, and to carry on the business of manufacturers of and dealers in and with electric wires, electricity meters, gas meters, cycles, motors, steam condensing and water-softening devices, electric lamps, switches, cut-outs, batteries and appliances, and the like, electricians, electrical and general engineers, contractors, &c. The first subscribers (each with one share) are:—H. E. Hill, 183, Leander Road, Brixton, cashier; A. C. Worman, 25, Shepherd Street, Plaistow, clerk; O. M. Boilon, 431, Liverpool Road, N., clerk; C. M. Murphy, 31, Victoria Road, Chelmsford, clerk; F. Hopkins, 29, Heron Road, Herne Hill, clerk; E. W. Hopton, 27, Haverhill Road, Balham, clerk; and R. M. Albery, Bridge Road, Chertsey, farmer. No initial public issue. The number of directors is not to be more than three; the subscribers are to appoint the first; remuneration as fixed by the company; L. A. Frank, of 31, Wiltshire Road, Brixton, is the first secretary.

Barnaby & Co., Limited (74,481).—This company was registered on July 28th, with a capital of £3,000 in £1 shares, to act as an electric supply company in all its branches, to create, accumulate, transmit and distribute electricity, magnetism or other similar agency, and to carry on the business of electrical and mechanical engineers, manufacturers of, agents for and dealers in electric, magnetic, telegraphic, telephonic and other appliances and apparatus, manufacturers of steam, hydraulic, pneumatic and other engines and appliances, &c. The first subscribers (each with one share) are:—W. Collins, 16, Damer Street, Sheffield, traveller; F. Newham, 394, Ecclesall Road, Sheffield, cutlery manufacturer; W. F. Barnaby, 195, Balmoral Road, New Brompton, Chatham, electrical engineer; C. W. Harrison, 35, Rustlings Road, Sheffield, manager; Mrs. R. Hides, 171, Northumberland Road, Sheffield; Mrs. L. Collins, 16, Damer Street, Sheffield; and W. Wreghitt, 37, Botanical Road, Sheffield, hosier. No initial public issue. The number of directors is not to be less than two nor more than five; the first are W. Collins and W. F. Barnaby; qualification, £50. Registered office, 18, College Street, Rotherham, near Sheffield.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Leeds Copper Works, Limited (62,225) [formerly "English Electro-Metallurgical Company, Limited. Name changed June, 1902].—This company's annual return was filed on June 5th, when all the shares were taken up in a capital of £700,000 in 300,000 preference, and 400,000 ordinary shares of £1 each. £1 has been called up on each of 200,000 preference shares, resulting in the receipt of £198,800. £1,200 remains in arrears. £500,000 is considered as paid on 100,000 preference and 400,000 ordinary shares. Mortgages and charges, *nil*.

Metropolitan Electric Supply Company, Limited (23,395).—This company's annual return was filed on April 8th, when the entire capital of £1,000,000 in 100,000 shares of £10 each had been taken up. £10 per share has been called up on 97,968 shares, resulting in the receipt of £979,680. £20,320 is considered as paid on 2,032 shares. Mortgages and charges, £470,000.

CITY NOTES.

Dick, Kerr & Co., Limited.

Messrs. Dick, Kerr & Co., who have for some time been sole selling agents for and large shareholders in the English Electric Manufacturing Company, Limited, of Preston, have now taken over the whole of the shares of that concern. The business of Dick, Kerr has been conducted as a private limited company so far, its shares being held almost entirely by members of the firm. The amalgamation has been effected by Messrs. Dick, Kerr & Co. exchanging £100,000 ordinary shares for the £200,000 in the English Electric Manufacturing Company, and they have exchanged £145,000 out of the £185,000 preference shares in the latter company. The debentures have not yet been dealt with, but it is intended to convert the Dick, Kerr & Co. 4 per cent. debentures to 4½ per cent., the same as those of the other company, and to raise the preference dividend to 6 per cent. all round. The capital of Dick, Kerr & Co. now figures at £840,000, and its profits for the last three years have averaged over £60,000, which is sufficient to pay the increased interest on the preference stock and debentures in the two concerns, and also to give a 10 per cent. dividend on the ordinary. For the current financial year the profits are estimated to be considerably in excess of previous years. The English Electric Manufacturing Company has also been earning substantial profits. It is stated that during the last 18 months these have been £67,000.

Anglo-American Telegraph Company.

Mr. F. A. Bevan presided last Friday at the half-yearly meeting of this company, and in moving the adoption of the report, said that the directors regretted that, owing to the falling off in the receipts for the first quarter, they were unable to pay the quarterly dividend which they had paid for some time past, namely, 15s. to the ordinary and 30s. to the preferred shareholders, and had only enough in hand to pay 12s. 6d. and 25s. respectively. The second quarter, however, brought increased traffic so far as to enable them to pay the usual dividend. The receipts decreased by £13,167, but this company was no exception to other telegraph companies in that matter. He believed that all of the submarine telegraph companies experienced a falling-off in the receipts, probably owing to a diminution in the volume of business. It now looked as though there was going to be an improvement, for instead of a decrease for the month of July, there was a slight increase over July of last year. Then, besides the decrease in the traffic receipts, the *Minia* repairing ship earned £5,605 less than in the previous year, owing to the fact that the cables of all of the associated companies remained in such good order that there was no need for repair. The fact was that they only had one repair to effect for one of their friends, and that was executed so rapidly that they earned very little by the *Minia*. The total decrease in traffic receipts amounted to £18,773, which was serious, but he did not think it was to be considered on the whole unsatisfactory. There was a considerable decrease of expenses which went some way to reduce the total decrease for the half year. The working expenses were down by £705, the law expenses by £516, and the repair ship cost £1,261 less; the value of cable expended was £2,463 less, the total decrease being £6,048, which being deducted from the decrease of receipts £18,558 left a net decrease of £12,510. The decrease arose simply from the volume of business being less, and the fact that their cables and those of their partners were in better order than they had been for a very long time, and he was glad to say that at the present time the cables were in good working order, with the exception of one small cable on the other side of the Atlantic which would be repaired very quickly. The directors watched carefully the development of wireless telegraphy, which was now associated not only with the name of Marconi but with other systems. What would eventually develop from it they were not in a position to say. They had been told time after time that they would see those systems established in a month or two or three, and now August had come and nothing apparently so far as he knew had occurred which should make their opinion differ from what they had expressed upon a previous occasion, that though this system would produce a certain class of telegrams, such as between ships and the shore, or between ship and ship, there was no reason, so far as they could see at present, to believe that they would compete with the class of telegram which this company and the other cable companies sent, because, as he had already said, they could not see that they would be able to compete with this company in accuracy or speed. As an instance, in the present week they, from their Stock Exchange office, were able to send no less than 1,063 messages in the space of two hours. So long as they were able to send telegrams with that speed and with perfect accuracy the directors did not think that Anglo-American shareholders need be greatly alarmed about the development of wireless telegraphy. Lord Kelvin had told him that he had given careful attention to this matter, and he did not believe the shareholders need be alarmed at the prospect. Of course they could not say what might happen, science developed in such a wonderful manner that it was impossible to predict or prophesy, but, considering their own speed and perfect accuracy, it would be a long time before wireless telegraphy could do them very much harm. After a few words relating to the French lawsuit, for which they had long had a favourable judgment, but could not get their money, the speaker formally moved the adoption of the report.

This was seconded by Mr. Burt, and carried unanimously after several deferred shareholders had aired a grievance about the renewal fund.

Baker Street and Waterloo Railway Company.

The report for the half-year ended June 30th last, to be submitted at the meeting on the 7th inst., states that the capital expenditure during the half-year amounted to £66,011. The estimate for the current half-year is £175,000. The construction contracts and agreements relating thereto have now been transferred by the Metropolitan District Electric Traction Company, Limited, whose capital was £1,000,000, to the Underground Electric Railways Company of London, Limited, with a subscribed capital of five millions sterling. Satisfactory progress is being made with the construction of the works. The company's Bill has passed through the Committees of both Houses of Parliament, and is now awaiting third reading in the House of Commons. The engineers' report, issued with the directors' statement, states that since their last report the works have made progress as follows:—The western running tunnel at Waterloo has been completed to Addington Street. The

eastern running tunnel has been continued southwards to a point 54 yards short of the Waterloo Station tunnel. On the north side of the river the shield chamber for the second station tunnel at the Embankment has been constructed, and the shield is now in course of erection. The eastern station tunnel at Oxford Street has been completed, and the headwall built ready for continuing the running tunnel. The western running tunnel has been continued from the point in Regent Street near Vigo Street, where it was suspended, to a point 230 yards south of Oxford Circus. On the northern section of the railway the eastern running tunnel, which was suspended in May last year at a point in Regent's Park, north of the outer circle roadway, was started again on June 30th last, and is now about to cross under the said roadway. At the station at Waterloo the lift chamber or booking hall has been covered in, and is ready for the internal fittings. At Piccadilly the works remain as they were at the last report, and at Oxford Street preparations are being made to start some underpinning work to enable the large lift shaft to be sunk.

Metropolitan District Railway Company.

The report for the half-year ended June 30th last says that the company has again suffered seriously from the competition of the Central London Railway, although the recent large reduction of fares at Ealing, Hammersmith and other West-End stations will, it is confidently believed, assist the company to regain its traffic. The Ealing and Harrow Railway is being now prepared for electric traction, and it is hoped that the railway will be opened before the end of the present year. The Metropolitan District Electric Traction Company, who contracted to erect the power house at Chelsea and electrically-equip the District Railway, has become absorbed in a larger company, with a subscribed capital of £5,000,000, known as the Underground Electric Railways of London, Limited. This company is rapidly pushing on with the erection of the generating station and the other works. The contracts for the construction of the Brompton and Piccadilly Circus Railway have been let and its land notices have been served. The works are now in active progress. An agreement has been made whereby the Brompton Company will construct the portion of the District Company's deep level line from Earl's Court to South Kensington.

North Metropolitan Tramways Company.

The report for the six months ended June 30th last says that the Bill for the electrification of the company's lines in Middlesex, the application for which was authorised at the last meeting, has passed both Houses of Parliament, and by arrangement with the Middlesex County Council and the Metropolitan Electric Tramways, Limited, it is now proposed to apply to the Board of Trade for their consent to a sale of these lines to the Metropolitan Electric Tramways, Limited, and an agreement to this effect will be submitted for confirmation at the meeting. The Act also contains power to increase the number of directors to six, and a resolution to this effect will be submitted to the meeting. The directors recommend that Mr. James Devonshire, the managing director of the Metropolitan Electric Tramways, Limited, be elected as such additional director.

Great Eastern Railway Company.

At last week's meeting of this railway company, Lord Claud Hamilton, who presided, said that the company's officers were considering, and had reported to the directors on, improved traction, both by means of steam locomotives and by the "electrification" of a portion of the line. These were matters which were receiving the constant attention of the board, but they had not yet come to any decision as to the method that ought to be adopted. The new decapod locomotive of exceptional power, which they were building as an experiment, was not yet completed, and they could not find in America or elsewhere any railway working by electricity trains of 13 carriages capable of conveying 656 passengers equal to a total weight of 210 tons at a two minutes' interval, which was what they required. It was doubtful whether a railway working such trains would, with the existing knowledge of electrical traction power, be commercially successful, which, of course, was the principal point to be considered, although there was no doubt that it would be possible to work the traffic in the manner indicated. As to existing electrical railways which conveyed much lighter trains, there was by no means unanimity of opinion as to the best mode of working, &c. The Central London Railway had been opened only two years, and yet the board of that company had decided on an alteration of their system of working. The shareholders would remember also the different opinions expressed at the inquiry before the Board of Trade as to whether the Ganz or the multiple unit system should be adopted for the "electrification" of the Metropolitan and the District railways. Again, before the Lords' Committee on the tube railways this session one expert said that Parliament made a mistake in allowing the Central London Company to build an 11 ft. 6 in. tube. Another expert, on the contrary, argued that the Central London tube was quite sufficient, and that a larger tube would prevent many undertakings from being a financial success. He alluded to other differences between experts, and said that the board did not, therefore, consider that they ought at present to bind themselves down to any particular system, even in order to prevent the extension of the tube lines into the company's district. One tube scheme, through Leyton and Walthamstow to Waltham, had been withdrawn, but the promoters announced that they would bring it forward again next session, while another, the North-East London scheme, which would compete with the Great Eastern line for its Tottenham and Edmonton traffic, had been passed by the Lords' Committee. To enable them to pay a dividend of 3½ per cent. on the ordinary shares, the promoters of the last-mentioned scheme estimated that they would carry 63,333,000 passengers per annum, which was equal, making the usual allowance of 25 per cent. for Sunday traffic, to 194,000 passengers per day. This was a number which, in practical working, could not be carried over a double line of railway; while the whole of the traffic carried by the Great Eastern, the North London, and the Great Northern railways from the district proposed to be served by the North-East London tube was only 27,215,147 per annum, or equal to 83,482 per day.

Blackpool and Fleetwood Tramroad Company.

The report for the half-year ended June 30th last, to be submitted to the meeting on the 21st inst., states that, including the sum brought forward from last half-year, the balance of profits, after providing for debenture interest, is £3,538, and the directors recommend a dividend at the rate of 4 per cent. per annum, which will absorb £3,000, writing off a sum of £500 to depreciation reserve, and leaving a balance of £38 to be carried forward to the current half-year. The number of passengers carried during the half-year was 679,740. The receipts from all sources amounted to £9,941.

City of London Electric Lighting Company.

The half-yearly interim report of the directors contains the following tabulated statements, showing the position of the company at various periods:—

Number of Customers and Lamps Connected
(After allowing for Disconnections on Account of Removals, &c.).

	Dec. 31, 1898.	Dec. 31, 1899.	Dec. 31, 1900.	Dec. 31, 1901.	June 30, 1902.
Number of customers being supplied	7,414	8,738	9,855	10,618	10,650
Number (equivalent) of 8-c.p. lamps connected	355,825	429,628	511,113	549,175	558,526

On June 30th, 1902, in addition to the lamps connected, there were 15,362 awaiting connection on completion of the consumers' wiring, &c.

Comparison of Half-yearly Gross Revenue.

Revenue.	First 6 months of 1898.	First 6 months of 1899.	First 6 months of 1900.	First 6 months of 1901.	First 6 months of 1902.
Gross revenue from sale of electricity for public and private lighting and meter rentals, excluding sundry receipts	£ 78,552	£ 99,213	£ 100,550	£ 126,122	£ 124,280
Increase over previous year	(286 decrease.)	20,661	1,337	25,572	(1692 decrease.)

After payment of interest on the first and second debenture stocks and loans, the net revenue for the first six months of 1902 (including the amount of £14,063 brought forward from 1901), subject to adjustment, was £63,864 available for depreciation, reserve, any special charges, and dividends on the preference and ordinary shares, &c.

From the above it will be seen—

(*a*) That after deducting the lamps disconnected at the request of consumers, principally owing to refusal to supply such consumers at unremunerative rates, the lamps connected to the company's mains show a net increase of 9,351 during the six months, notwithstanding the present competition.

(*b*) That the reduction in the working expenses, to which your chairman called attention at the last ordinary general meeting, is being maintained, especially in the consumption and in the price of coal.

As a consequence, the net revenue for the past six months shows a considerable increase, as follows:—

	First six months of 1900.	First six months of 1901.	First six months of 1902.
Net revenue for half-year	£17,916	£39,411	£49,801
Add amount brought forward from previous year..	1,622	11,342	14,063
Total available	£19,538	£50,753	£63,864

The dividend on the company's preference shares for the six months ended June 30th last has been paid. The appeals to the House of Lords in respect of the contracts with the Corporation of London will probably not be heard until after the Long Vacation.

(*Continued on page* 232.)

EDOUARD HOSPITALIER.

The Société Internationale des Electriciens will, in 1903, have a distinguished president, an electrical engineer who has long attracted the attention of the electrical world by his researches, his originality, and the correctness of his methods. In 1877, M. E. Hospitalier left the Ecole Centrale, Paris, with diplomas conferring upon him the titles of engineer of arts and manufactures and mechanical engineer. He immediately devoted himself to the electrical industry, which was then undeveloped. In 1879 he became secretary to the journal entitled *La Lumière Electrique*, and in 1881 he joined the staff of *L'Electricien*, in the same capacity, and was appointed a member of the Chancellor's office of the International Congress of Electricians. The question of the first electrical units, which were adopted at this time, interested him greatly, and all the articles that he published at that period, and we might add, that he still continues to publish, have always tended to define clearly electrical elements and units, and to insist on exact measurements. In 1882, when the City of Paris founded the School of Industrial Physics and Chemistry, M. E. Hospitalier was chosen as professor of electricity. He fitted up all the laboratories required for measurements, experiments, and tests of all kinds. The course of lectures given by him for 20 years, and constantly modified according to the progress of electrical science, is a model of its kind. What is especially admired in him, is his method, the clearness of his explanations and his justice in appreciation. We have only to consult the record of the pupils turned out by him to see that they have been taught in a good school.

Edouard Hospitalier, President-Elect of the S.I.E.

In 1883 M. Hospitalier became editor-in-chief of *L'Electricien*, and retained this position until 1890.

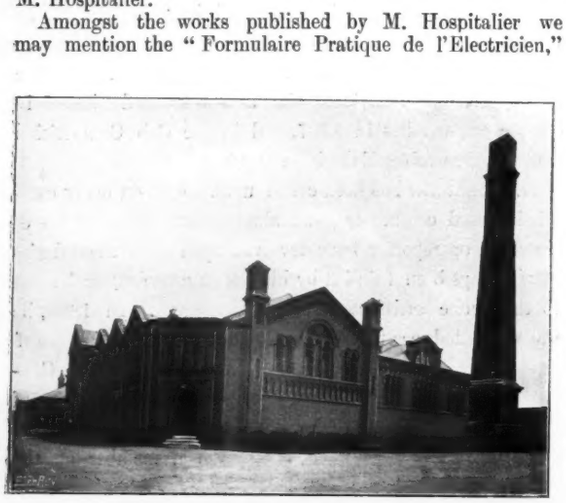
M. Hospitalier has taken a great interest in the Société Internationale des Electriciens. In 1884 he was elected secretary of the Society. In 1893 he was appointed vice-president; and now in 1902 he has just been elected president for the year 1903—4. During this period he has constantly written papers of the highest importance for the Society. In 1884 he wrote a paper on transformers of electrical energy, and later on another on electrical definitions, notation and symbols. In 1885 he spoke on electrical notation. In 1886 he described an automatic switch applied to the charging of electric accumulators. In 1888 he was studying electric meters. In 1891 he visited the Frankfort Exhibition, and gave demonstrations of polyphase alternating currents. He read a paper on the provisional programme proposed for the International Congress of Electricians at Chicago in 1893, and in the same year he visited America. M. Hospitalier was one of the first to speak of carbide of calcium and its applications in the manufacture of acetylene. He also interested himself in electric automobiles in 1897, and in the Cab Competition and the Automobile Exhibition of 1898.

M. Hospitalier has been called upon to sit on many commissions and committees, and almost always the duties of secretary or reporter have devolved upon him; these duties have always been fulfilled by him most conscientiously, and to the entire satisfaction of his colleagues. In 1888, he was appointed secretary of the Committee of Organisation of the International Congress of Electricians of 1889. In 1889 he was a member of the Electro-Technical Committee of the Universal Exhibition of 1889, and secretary of Section II. (Industrial Applications) of the International Congress. At this period the City of Paris was intent upon the Halles Electrical Works. M. E. Hospitalier was a member of the Electro-Technical Committee of the City of Paris. In 1890 he acted as reporter to the judges in the Electric Meter Competition instituted by the City of Paris.

In 1892 he became editor-in-chief of *L'Industrie Electrique*. In 1891 he was vice-president of the International Congress of Electricians at Frankfort-on-the-Main; in 1893 he was official delegate at the Chicago International Congress of Electricians; in 1896 he was vice-president of the International Congress of Electricians at Geneva; in 1898 he was honorary president of the jury of the electrical section of the Turin Exhibition. Lastly, in 1899 he was reporter to the Admission and Installation Committees of class 23, at the Paris Universal International Exhibition, and in 1900, he was reporter to the jury of class 23 (The Mechanical Production and Utilisation of Electricity), and reporter to the International Electrical Congress. M. Hospitalier's scientific researches have been described in *L'Electricien* (1881—1890), and in *L'Industrie Electrique* (1892—1902). They had for their special object the industrial and scientific methods of measurement that have been used since 1882 at the School of Industrial Physics and Chemistry of the City of Paris, the graphic study of the working of

dynamos, accumulators and electric meters, and the distribution of electrical energy by continuous, alternating, simple and polyphase currents. The unification of electrical units and terminology has always been an object of special interest to M. Hospitalier.

Amongst the works published by M. Hospitalier we may mention the "Formulaire Pratique de l'Electricien,"



Yarmouth Corporation Electricity Works.

which has appeared every year since 1883, "Les Compteurs d'energie électrique" (1888), "Les Recettes de l'Electricien" (1895), "Polyphased Alternating Currents," written specially for the proprietors of the Electrical Review, and published by them in English in the year 1896, and "Le Vocabulaire technique industriel et commercial Français — Anglais — Allemand" (1900). Amongst the instruments invented by M. Hospitalier is the Ondograph, described and illustrated in the Electrical Review for June 13th and 20th, 1902, which is so valuable for registering the wave-form of electric currents. In 1900, at the conclusion of the Exhibition, M. E. Hospitalier was made a Chevalier of the Legion of Honour.

To sum up, M. Hospitalier is an eminent electrical engineer, a professor of industrial electricity of the highest merit, and one who has rendered most valuable service in industrial instruction. He takes great interest in automobilism, and is now engaged upon an original motor car, which will be worked by petroleum and by electricity without accumulators.

His chief characteristic is his independence and freedom of opinion, which have made him many friends and, perhaps, some enemies.

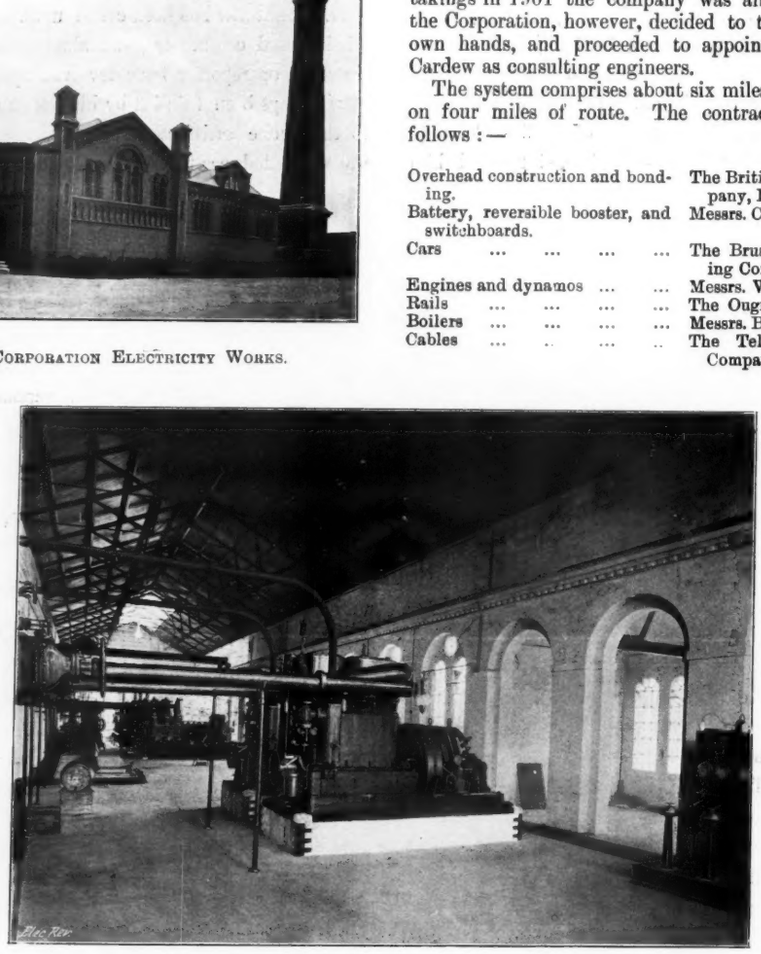
An *entente cordiale* has existed between ourselves and the subject of our sketch ever since he entered the domain of technical journalism, and in the same year that M. Hospitalier joined *L'Electricien*, the Electrical Review, previously published monthly, and later fortnightly, became a weekly paper. In the early days he was a frequent contributor to our columns, and on his writings we have always set the highest value.

GREAT YARMOUTH TRAMWAYS.

The electric tramways constructed by the Yarmouth Corporation were opened last month, and we give a brief account of the installation herewith. The Corporation obtained powers to carry out the work in 1899, but at first hesitated between putting them in force and leasing them to a company. The Yarmouth & Gorleston Tramway Company, whose lease expires in 1904, had been bought up by the British Electric Traction Company, Limited, and when the Corporation invited tenders for leasing both undertakings in 1901 the company was almost the only bidder; the Corporation, however, decided to take matters into its own hands, and proceeded to appoint Messrs. Preece and Cardew as consulting engineers.

The system comprises about six miles of single track, laid on four miles of route. The contracts were awarded as follows:—

Overhead construction and bonding.	The British Insulated Wire Company, Limited.
Battery, reversible booster, and switchboards.	Messrs. Crompton & Co., Limited.
Cars	The Brush Electrical Engineering Company, Limited.
Engines and dynamos	Messrs. W. H. Allen, Son & Co.
Rails	The Ougrée Works, Belgium.
Boilers	Messrs. Babcock & Wilcox.
Cables	The Telegraph Manufacturing Company, Limited.



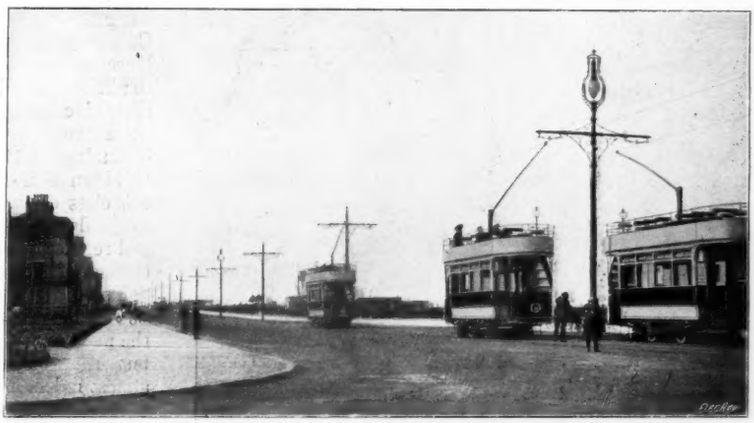
Yarmouth: Tramway Plant in Power Station.

The permanent way was laid by Mr. J. W. Cockrill, borough surveyor, with local labour, the time occupied being about 8 months. The rails weigh 90 lbs. per yard, and are in lengths of 45 ft. The foundation consists of a concrete bed 6 in. thick, on which the rails are laid to a gauge of 3 ft. 6 in. The rails are tied every 6 ft., and cross-bonded at intervals of 120 ft. The special work at points and crossings was carried out by Messrs. Askham Bros. & Wilson, of Sheffield. The steepest gradient is 1 in 27, and the sharpest curve 48 ft. radius.

Special Work on Yarmouth Tramways.

The bonds are of both the Crown and plastic type. The trolley wire is ·409 in. in diameter, and is suspended from brackets carried on side and centre poles, as found convenient. The poles are also utilised for telephones and arc lamps. This work was carried out under the supervision of Mr. Morshead, for the B.I.W. Company, Limited.

The cars, which, with their trucks and equipment, were built entirely by the Brush Electrical Engineering Company, Ltd., are capable of seating 49 passengers each; they are of the 1,000 A single-truck type, carrying two 25-H.P. motors. The controllers are of the Brush type, and the trolleys of Messrs. Brecknell, Munro & Rogers's pattern. Hand and electrical brakes are fitted. Fourteen cars have been put into service so far.



Yarmouth: Cars on Line.

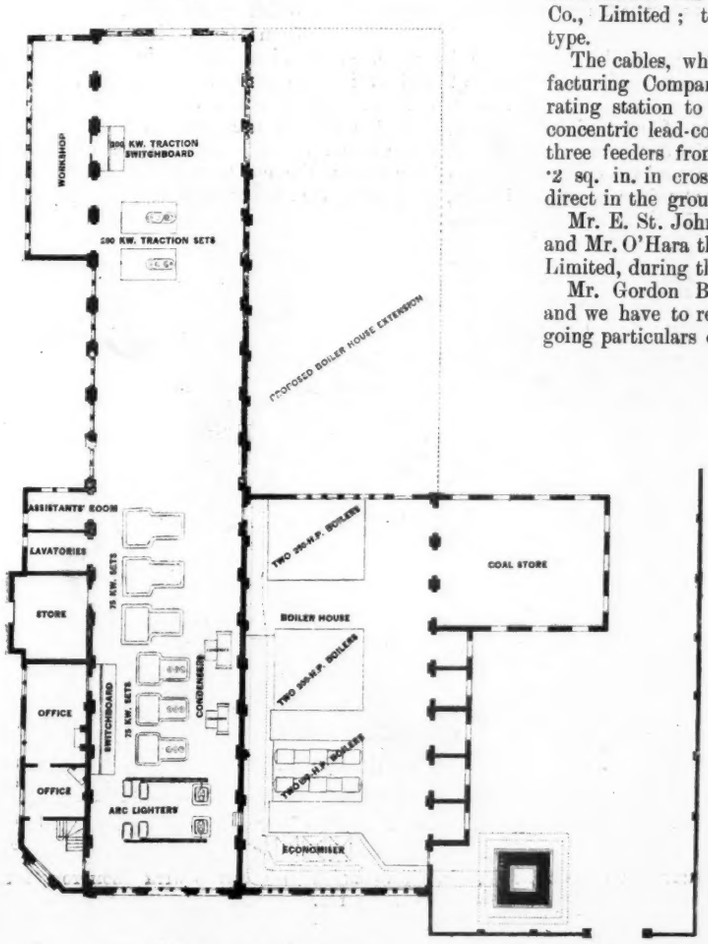
Messrs. James Russell, of Wednesbury, and the valves are of Messrs. Hopkinson's well-known pattern. The steam traps are of the Geipel type, and the lagging of sectional magnesia.

The engines are of Messrs. W. H. Allen's vertical compound condensing type, of 300 I.H.P. each; the cylinders are 14 in. and 24 in. × 10 in. stroke. The engines are fitted with forced lubrication, and run at 360 revolutions per minute. They are direct-coupled to six-pole compound generators, supplied by the British Schuckert Company, having an output of 360 amperes each at 560 volts. The battery consists of 240 E.P.S. cells, of 360 ampere-hours capacity, and works in combination with a reversible booster of the Crompton type. The switchboard was also made by Messrs. Crompton and Co., Limited; the circuit breakers are of the B.T.H. type.

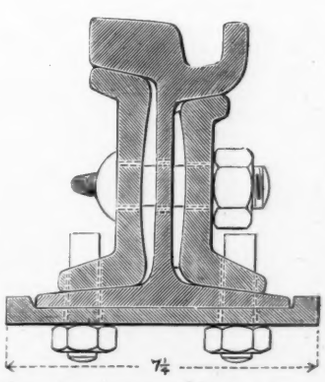
The cables, which were supplied by the Telegraph Manufacturing Company, consist of two mains from the generating station to the battery sub-station, of the ·25 sq. in. concentric lead-covered type, drawn into Doulton ducts, and three feeders from the sub-station to the trolley wire, each ·2 sq. in. in cross-section, single core armoured, and laid direct in the ground.

Mr. E. St. John represented Messrs. Preece and Cardew, and Mr. O'Hara the Brush Electrical Engineering Company, Limited, during the work of construction.

Mr. Gordon Bryant is the borough electrical engineer, and we have to record our indebtedness to him for the foregoing particulars of the system.



Plan of Yarmouth Station.



Section of Rail Joint.

To meet the requirements of the tramways, extensions had to be carried out at the generating station, and new machinery installed. The boilers are of Messrs. Babcock and Wilcox's standard type, two in number, and are fitted with superheaters. The steam pipes were fitted by

Lincoln.—For some time negotiations have been in progress between the Lincoln Tramway Company and the Electricity Works Committee of the Corporation relative to the proposed purchase of the tramway undertaking, and a special meeting of the City Council has been summoned for September 2nd for the purpose of giving the company notice of intended purchase.

THE ARC WORKS, CHELMSFORD.

It is always a pleasing duty to draw attention to the part which has been so long and ably played by Messrs. Crompton and Co., Limited, in the electro-technical industries, and we gladly take this opportunity of once again giving prominence to this pioneer firm, and of entering at greater length upon the objects of the visit to Chelmsford to which we made brief reference in our last issue.

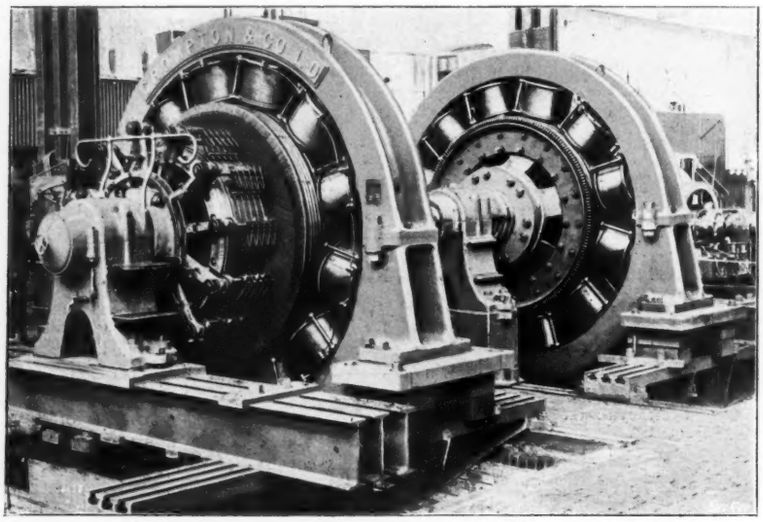


Fig. 1.—Generators under Test.

It is probably well within the recollection of our readers that on August 5th, 1898, we published an exhaustive and profusely illustrated description of the Arc works, so that our present article will be devoted to extensions which have recently been made. There is no need to go into particulars of the main shop, which is practically as it stood in 1898, with the exception, we believe, of three additional bays.

We may, however, mention that amongst the large number of interesting modern tools installed in different parts of the shops may be seen a 25-ft. stroke double-headed side planing machine by Messrs. Geo. Richards & Co., an 18 ft. turning and boring mill by Messrs. Smith and Coventry, a powerful Ingersoll milling machine, a large band saw for cutting magnet bars, by Messrs. Noble & Lund, and other tools by most of the representative firms in England as well as many of the leading American manufacturers. One particularly useful combination of tools is to be seen in the erecting bay. It consists of a large floor plate upon which a number of portable tools can be placed in cases where it is necessary to take the tools to the work instead of *vice versâ*.

Next in importance to the main shop is that devoted to the manufacture of arc lamps, switchboards, and the various electrical instruments for measuring and testing purposes. Until February, 1902, the whole of these lighter manufactures were produced by Messrs. Crompton & Co. at their old works in Moulsham (some half mile from the present building), which grew from the original workshop established by Mr. R. E. Crompton in 1878. These works, however, as is usual under such conditions, had become increasingly inconvenient as a result of successive enlargements, and in the beginning of 1901 it was decided to build an entirely modern shop for this class of work in close proximity to the dynamo shop at the new works, and regular work was commenced at the end of February, 1902.

The floor space is 270 ft. wide by 160 ft. long; the width of 270 ft. is the maximum that the ground allows, but the length can be extended almost indefinitely.

A space of 40 ft. by 160 ft. is screened off at the west side of the shop, and forms the instrument department. The rest of the shop, comprising the lamp and switch departments, is quite open. A space of 55 ft. in width is reserved across the whole of the north end of the building as a store, and is separated from the working portion of the shop by an open partition. A portion of this store is again fenced off in the centre of the building, and is used as a tool shop. The machine shop occupies a width of two bays and a half in the centre of the building; the east side is given up to the manufacture of the various types of arc lamps, the construction of switches, switchboards, projectors, &c., being carried on on the west side

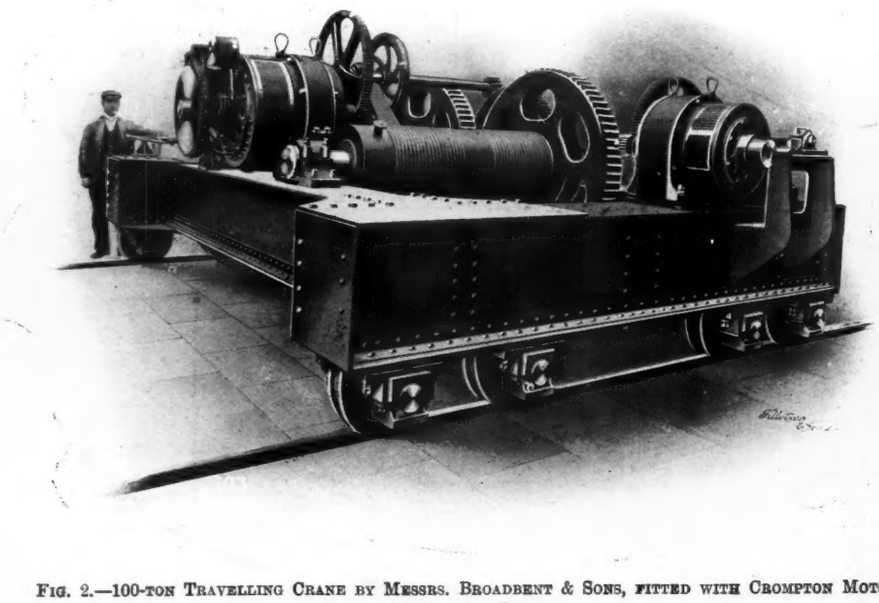


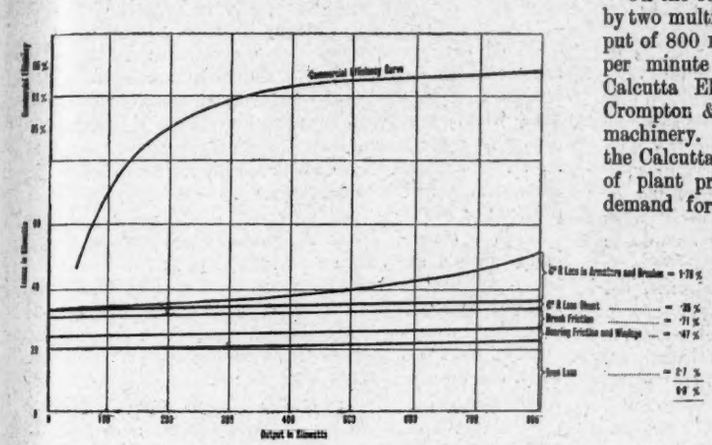
Fig. 2.—100-ton Travelling Crane by Messrs. Broadbent & Sons, fitted with Crompton Motors for Electrical Driving.

On the south side is a range of offices for the shop manager, with his draughtsmen and office staff, so placed, that effective supervision is maintained over the whole of the shop.

The shop is entirely lighted by arc lamps, the portion devoted to instrument work having the arcs inverted, so as to avoid any shadows. Low pressure steam heating is used throughout, and there is a complete system of fire mains and

of gas mains for the supply of "Dowson" gas, which is used for brazing, soldering, &c. The whole shop is motor-driven, the current for this and the lighting being obtained from the power house of the dynamo shop.

In both the lamp and switch departments there is a large plant of interesting and up-to-date tools to be seen, notably turret drilling and tapping machines for dealing rapidly with the numerous different sized holes in the arc lamp frames. With such machines it is possible to fix the frame into its drilling jig, and drill and tap all the holes before it is removed from the jig, even though there may be many different sizes. There is also a number of most modern capstan lathes by both English and American makers.



Efficiency and Loss Curves of the Calcutta 800-kw. Dynamos.

The department is also provided with a test room in which all lamps are tested before being sent out.

In the instrument department, which is occupied chiefly in the manufacture of measuring instruments, amperemeters, voltmeters, potentiometers, and other high-grade instruments, the firm is also engaged in originating gauges and cutting tools for the system of small screw threads recommended by the British Association Committee in the Bradford report of 1900. These gauges and tools are being made on a system now being worked out in the shops under notice, and, it is hoped, will give a good degree of accuracy without excessive cost. A high perfection of geometrical form should be obtained in practice. An electrical contact gauge measures easily within one-thousandth of a millimetre. Messrs. Crompton attach much importance to the establishment of accurate dimensions and forms for the small appliances in their instrument shop, and are paying a great deal of attention to this subject. Some very interesting and accurate tools are also installed in this shop, including lathes ranging in size from those used by watchmakers to machines with 5-in. centres, together with small milling machines, &c., of different types.

It may be mentioned that the method of remuneration adopted throughout the works is largely piece-work, but the premium system in a modified form is in use for standard articles. The time offices are provided with "Bundy" time recorders.

The electrical energy for the service of the whole of the works is provided by three direct-coupled generators—two low-speed sets and one high-speed combination. The former consist in each case of a 150-kw. continuous current Crompton generator coupled to a 240-h.p. horizontal engine by Messrs. Marshall, Sons & Co., of Gainsborough, the engines being fitted with Proell-Marshall valve gears. The generators each have a 6-ft. diameter armature built up on the engine crankshaft, and the eight-pole field magnets are entirely of steel. The high-speed set is a 200-h.p. combination, the dynamo being a bipolar machine and the engine a Willans.

Steam is provided by three Babcock & Wilcox boilers, each rated at 5,000 lbs. of steam per hour. Two of these are fitted with the same firm's latest pattern Scotch furnaces for burning smoky coals, and have superheaters of the latest type, the third having a chain grate stoker for small fuel. A Green's economiser is also fitted. The condenser is placed above the boiler house on steel stanchions; it is of the evaporative surface type, made by Ledward, and is large enough to condense the steam when either of the engines is working up to 240 h.p. The vacuum is obtained by an air pump on the Edwards principle, made by the Central Marine Works, of Hartlepool, and driven by a motor. The centrifugal pump for circulating the water is also electrically driven, and the feed water is forced into the boiler by a three-throw horizontal pump, motor-driven.

The switchboard, by which the supply of current to the entire works is regulated, has been designed in an exceptionally substantial manner, and represents Messrs. Crompton and Co.'s latest practice as regards details of the switches and other gear for low pressure distribution.

On the occasion of our visit the testing bed was occupied by two multipolar generators, each capable of giving an output of 800 kw. when running at a speed of 230 revolutions per minute (fig. 1). These machines were built for the Calcutta Electric Supply Corporation, for whom Messrs. Crompton & Co. are contractors for the whole plant and machinery. It may be of interest to note, in passing, that the Calcutta Company started in 1897, the first instalment of plant providing for a total output of 888 kw. The demand for lighting and power has, however, been so rapid that the stations have been extended to 3,500-kw. capacity, which will include the two machines above mentioned, and further extensions are still under consideration.

The generators are fitted with slotted drum-wound armatures 7 ft. in diameter; the magnets are compound wound, the outside diameter of the yokes being approximately 12 ft. The commutators are fitted with carbon brushes, and all bearings are self-oiling. The net weight of the armatures is 13 tons each, the total weight 30 tons for each machine. Although the generators were primarily designed for lighting purposes they embody all the essential qualities of dynamos for traction work, and could be used equally well in that capacity if necessary at a future date.

Being designed for use in India, the greatest care has been taken to ensure the cool running of these generators, and even on continuous work at their normal load the temperature rise of the machines is below the average. Their efficiency is very high, reaching 94 per cent. at full load, and they run

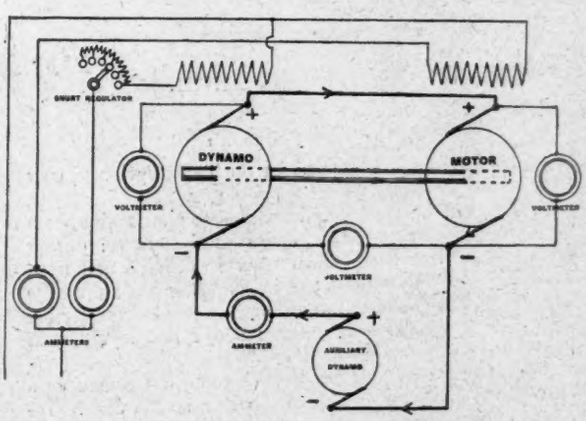


Diagram of Connections for Efficiency Test.

sparklessly without brush shifting from full load to no load. Three slightly larger generators have been supplied by Messrs. Crompton & Co. to the Glasgow Corporation.

Fig. 2 is an illustration of a 100-ton travelling crane, by Messrs. Broadbent, and as supplied by the Arc Works. The motors for this are of Messrs. Crompton's protected type, fitted with slotted drum-wound armatures, commutators of hard drawn copper, carbon brushes, and series-wound field magnets.

They are all wound for a voltage of 220, and run in either direction at any load with fixed brushes.

The hoisting motor is rated at 35 b.h.p., and is fitted with a rim brake electrically controlled. This brake and controlling magnet is mounted direct on the motor, so that the motor and brake are self-contained.

The motor driving the longitudinal travel is of 25 B.H.P., and the motor driving the cross travel is of 10 B.H.P.

The machines are controlled by starting and reversing switches of the liquid type, which give extremely fine regulation.

The cross conductors on the crane are of bare copper, the collecting shoes being mounted directly on the crab, and the span of the crane is 36 ft. 6 in.

The offices, main shop, lamp shop and instrument shop are all interconnected by telephones, and by means of an exchange in the general offices can be connected to the telephone system of the country—an arrangement which conduces not only to the convenience of the staff, but also to that of the firm's customers and to the expeditious and accurate execution of orders.

A large mess-room and wash-house for the men is in course of erection on a portion of the company's property, and the upper portion of this will be fitted as recreation and dining rooms for the staff, pupils, &c., while the workmen's dining-room will be used as a recreation room for the men in the evenings. In addition the men have a library, a sports club, and a sick benefit club, and by the granting of small allotments at a nominal charge and in other ways Messrs. Crompton & Co. make every effort to secure the welfare and goodwill of their employés.

At the conclusion of our description of the Arc works, just four years ago, we said :—

"With such a combination of machinery, and with the experience gained by years of study of Continental methods, Messrs. Crompton should have no difficulty in meeting the enterprising German or other foreigner on his own ground, and competing on favourable terms for the world's requirements in electrical manufactures."

Last week Lieut.-Col. Crompton was interviewed by the representative of a commercial contemporary, and the gallant officer's opinion on the position occupied by the English electrical contractor to-day was not very comforting, so far at least as South Africa is concerned. The Germans and Americans will have the first look in, he says, in spite of anything we can do, but he thinks that English engineers will have a chance after a bit. For ourselves, we are more optimistic; we have every confidence that our trade with South Africa will experience a substantial development at no distant date.

CORRESPONDENCE.

The Salary Scandal.

As one of those who applied for the Tonbridge *prize*, may I be allowed to justify myself for so doing.

I have had an experience extending to almost nine years in workshops, drawing office, and central stations; during the whole of this time I have "scorned delights and lived laborious days," and nights too, in acquiring the knowledge which our exceptionally interesting but exacting profession requires. And now, at 27 years of age, I find myself with under £150 per annum.

I might, as you suggest, have become a footman or a chaffeur at much less expense in labour and in cash. Indeed, I have asked myself again and again, in Miltonian phrase—

> Were it not better done as others use,
> To sport with Amaryllis in the shade
> Or with the tangles of Naera's hair.

But it is too late now, and I have grown too fond of engineering to desert it.

The great majority of jobs for which my experience has fitted me are advertised at from £100 to £150 per annum (the companies are little better than the municipalities in this respect). As you must know, for every such job advertised at least 100 applications are sent in, so that even in those cases where the advertisement is not merely "formal," the chance of obtaining the job is very remote. The large number of applicants, even when the rate of pay is so low, proves that the supply of such men as are qualified far exceeds the demand; this being so, it is almost hopeless to expect better salaries to be offered, so I rely on my 100 to 1 chance, and hope to get the prize—if not this one then another. I don't think the salary is enough; of course it isn't, but I see no prospect of getting anything better, and as things are, £150 per annum in an inexpensive place like Tonbridge is a temptation to

Esperan.

In the sixth chapter of his "Considerations on Representative Government," J. S. Mill dwells upon the dangers and infirmities of the system. Classifying what he terms the *positive* evils of governments he writes, "first, general ignorance and incapacity, or to speak more moderately, insufficient mental qualifications in the controlling body." Enlarging on this point he proceeds further on in the chapter "no progress at all can be made towards obtaining a skilled democracy unless the democracy are willing that the work which requires skill, should be done by those that possess it. A democracy has enough to do in providing itself with an amount of mental competency, sufficient for its own proper work, that of superintendence and check. . . . . In proportion, as its composition fails to secure this amount, the assembly will encroach, by special acts, in the province of the executive."

That a certain standard of intelligence must be reached before people are aware how little they know, is as true of the representative body as it is of the individual, and it looks dangerously as though the average of intelligence in many local councils is not up to this standard.

They elect an engineer fully believing that they, as a body, can do much of his work better than he could himself. They select his staff; maybe compel him to purchase inferior stores against his better judgment; call for an explanation if he discharges a coal-trimmer, and generally encroach on his powers both as engineer and manager. As a result he has a low official *status* and a correspondingly low salary.

A.M.I.E.E.

CITY NOTES.

(*Continued from page* 226.)

Central London Railway Company.

The fourteenth ordinary general meeting of the shareholders of this company was held on Tuesday at the Holborn Restaurant, Sir Henry Oakley presiding.

In proposing the adoption of the report, the Chairman said he thought he might say that their past year showed some very encouraging features so far as the working of the railway, and the results of the working, were concerned. Dealing first with the capital expenditure, they had received on debenture account £107,000, and they had spent £21,537. The chief items of capital expenditure were in the purchase of land at Shepherd's Bush for enlarging their station there, and for providing additional lifts at the Marble Arch, where they had completed a purchase which they had made some time ago in anticipation of enlarging the station there, and in the provision of new motor cars, which they had determined to establish with a view of avoiding the complaints which they received on account of vibration. They hoped that the new motor cars would begin to be delivered to them in October, and that before they met again they would be in good working order, and would obviate the evil of which residents along the line had more or less complained. Turning to the working, he thought, on the whole, they had done exceedingly well. They had increased the number of their passengers by very nearly 2½ millions in the half-year. In the 26 weeks they had carried 23 millions of passengers, which included 2¾ million workmen at half fares. The average fare remained practically about the same—it was now 1·88d., as against 1·90d. The gross receipts in the half-year amounted to £185,118—£20,000 more than in the corresponding period, which practically represented an increase of 12½ per cent. The average earning per train-mile—which was one of the tests by which they arrived at whether they were working profitably or not—was this year 5s. 8d., last year it was 5s. 2d. Therefore for every train-mile that they ran they were earning 6d. more than in the corresponding period, and they ran 15,000 more miles in the course of the half-year to earn that additional £20,000. But the most satisfactory feature about it was that an additional revenue had been earned without any real addition to their working expenses. The accounts showed an increase of some £3,000 in expenses, but if they were analysed, it would be found that rates and taxes were £5,153 more than last year, due to the fact that in their early stages the company was not assessed to the full; so that really they had earned £20,000 more on an expenditure of £2,300 less than in the corresponding period. Including the balance over from last year, they had £98,465 to divide, and after

providing for the debenture interest, £82,600 remained. Out of that they recommended the payment of a dividend at the rate of 4 per cent. on the original stock and on the preferred stock, which would absorb £47,000, and also to provide £9,994 for the dividends on the deferred stock, which under the Act was not payable until the result of the year's working had been ascertained. That left them with an available balance of £25,600 to carry forward. He had been asked why they carried so large an amount forward, seeing that £14,000 of it would be sufficient to pay a dividend at the rate of 5 per cent. instead of 4 per cent. The board, of course, gave that question most careful consideration, but they asked the shareholders to adopt the course they recommended because it was, on the whole, the most prudent. They had to face the expenses incurred in their unsuccessful Bill of this session; they had also to face the improvements and alterations necessary to avoid vibration, and they were unable to ascertain precisely what those further charges would be, and they thought, therefore, it would be much better to wait until the end of the year before they divided any surplus. By that time they would have a fuller knowledge of all their liabilities, and they hoped and believed they would also, in the course of this half-year, add so sensibly to their profits that they might face the future without fear or misgiving. The question of ventilation had occupied the attention of the board. Some people were good enough to say that the air of their tunnels was not so good as they would like. To meet their views and to try and add to the comfort of their passengers, they now pumped the air out of the tunnel every night. They could not effectively do it in the day time, but it was done every night, and on the whole the atmosphere was infinitely purer than any other. It had been examined by the local medical authorities, and they had also offered facilities for the London County Council's scientific advisers to examine it. They had not yet received their report, but they had an inkling that it would be a tolerably good one. Referring to the Bill which they promoted in Parliament this session, he said the board, of course, thought that the House of Lords was wrong, and the more they looked into the subject the more satisfied they felt that in the interests of the public their Bill would have been preferable to that of their opponents who started as three separate companies, but who, when they came into the Committee room and found themselves opposed by their circular route, combined their forces, and succeeded in satisfying their Lordships that competition was very desirable in the interests of the public.

Lord Rathmore seconded the motion.

Replying to Mr. Donkin, the Chairman said that although the House of Lords Committee indicated that they would give them power to make an extension at the City end, and also at Hammersmith, in the nature of a loop, they thought it would not be wise to undertake that expenditure, because the scheme that they submitted before the Committee, though good as a whole, would not be so useful or commercially profitable if they only had the portion which the Committee suggested that they might take, and therefore they declined to do anything. The report was adopted.

City and South London Railway Company.

Mr. C. G. Mott presided on Tuesday last week at the half-yearly meeting of this company. This being practically the first half-year of the operation of the complete system, the chairman in moving the adoption of the report, went briefly over the past history of the railway since it commenced working 12 years ago, dwelling upon the difficulties of pioneering electric railway work, the patience of the shareholders, the efficiency of the staff and management, and the assistance of financial men in the city who found money when it was not forthcoming from shareholders. At last they had brought the undertaking to a condition in which it might be fairly said to be a remunerative line, as the dividend proposed for the ordinary shares was 3 per cent., the highest ever paid. The capital expenditure on the line up to the present stood at £2,464,408, and the net revenue for the half-year after payment of working expenses was £44,405 or £88,810 per annum. That gave a return of 3·60 per cent. on the capital expended, but if they deducted from the "capital expended," the cost of issuing capital at a heavy discount, the net expenditure was brought down to £2,200,000, which made the return fully 4 per cent. upon the actual cost of the line. With a railway such as this affording a permanent and not-likely-to-be-altered investment, a rate of 4 per cent. was a rate which would always raise and command the money in the market; therefore, he said that now they had solved the last problem left to them, for they had made the railway a profitable one worthy of investing in. After a few further remarks, Mr. Mott gave his usual statement of the accounts. On capital account they had received during the past half-year £71,824, and had expended £46,768, showing an excess of receipts amounting to £25,056, which had gone to reduce the debit of capital account. As regards the revenue, passengers had increased by 3,304,334, and the amount received from that source had increased over the corresponding period of last year by £25,137, in addition to which there was an increase on season tickets of £692, making the total increase from passengers £25,829. Other items, such as parcels, transfer fees, &c., also showed increases, making an increased total of £26,708. To get that it had cost an increase of £2,694 for increased locomotive and generating power; traffic expenses had increased by £3,924, general and other charges also showed increases, bringing up the net cost increase to £7,860 for earning £26,708. There was thus a net improvement of £18,848 in revenue. After payment of the dividends, £1,749 would be carried forward as compared with £733. A further £2,000 had been paid off the renewals account, which now stands at £1,034. The train-miles run this half-year had been 618,470, an increase of 174,010, due to the Islington extension. The number of trains also increased, so as to give a faster and better service, to 100,975, an advance of 7,383. The number of passengers was 9,192,120, an increase of 3,304,334. The passengers per train had averaged 91·03 against only 62·91 a year ago, and the receipts per train had risen to 15s. 3d. against 10s. 10·8d. last year. The receipts per train-mile were 2s. 5·82d. against 2s. 3·84d. There had been a very large addition to the short-distance passengers. The most satisfactory item was the further reduction of the working expenses to 44·74 per cent. as against 52·36 per cent. last year. As the traffic increased this item had been steadily coming down, and he hoped it would continue to do so. The expenses per train-mile had been 1s. 1·95d. against 1s. 3·19d. The locomotive charges (power) had been 4·59d. per train-mile against 4·93d. last year, showing decreases everywhere. The line was being worked very economically, and the traffic expenses had decreased to 6·13d. against 6·40d. last year. He thought they could fairly congratulate themselves upon the result. After referring to the benefit derived from the subways which afforded facilities for interchange of traffic with other railways, and mentioning the incomprehensible rejection of the company's Bill for the Euston extension which is to be reintroduced again next session, he proceeded to refer to the City and Brixton Bill. He said that they arranged to abandon the principle part of their line and make only a small portion of it. They entered into an agreement to work that portion with their whole line upon terms which, if the Bill were passed, ought to easily obtain the funds for the purpose of making that piece; at the same time they thought the arrangement was a satisfactory one for this company. That Bill was still before Parliament. It had been delayed because of the advertisement of a company calling itself the City and Surrey Electric Railway Company, a provisional syndicate. They had had no connection with that railway and did not know the people. It was formed apparently to take over the position of the promoter of the Brixton Bill to find the capital; therefore they, whoever they might be, would stand in the same relation to this company as the promoters of the Brixton line did at present. As far as he could read or understand the prospectus—it was not very easily understandable—they would propose to drop the present Bill before Parliament and carry out the whole of the Brixton scheme. As far the City & South London Railway were concerned they would be glad if the money was raised because the lines would bring traffic over the existing portions of their railway. However they did not know what the promoters' intentions were: the Bill now before Parliament must either be dropped or passed within the next few days.

Mr. Grenfell seconded the motion and it was adopted. The dividend was approved, and suggestions made by shareholders to increase the directors' remuneration (it now stands at £1,300 per annum) were left over until next meeting.

Great Northern and City Railway Company.

Sir Charles Scotter presided on Friday last at the meeting of this company held at Westminster Palace Hotel. In moving the adoption of the report, he said that the line should have been completed at the end of June last, but it was not completed from various circumstances. On Wednesday, July 30th, he and his colleagues went to inspect the line, and he might say that they had a difference of opinion with the contractors as to when the line would be ready for opening for traffic. The contractors took a sanguine view, and were of opinion that the line between Drayton Park and Finsbury Pavement should be opened in the course of four or five months. His own experience was that a contractor must be allowed a month or two longer than he asked for, and probably those two stations would be ready by the end of the year. They also inspected the generating station in Poole Street, Regent's Canal. A fine and very spacious generating station—one of the largest in London—had been put up, and he proceeded to give a description of what they had seen. The engine house was practically finished; its dimensions were 52 ft. by 122 ft., and about 60 ft. high, excluding the basement. It contained four engines, each capable of developing in continuous running about 1,600 I.H.P., and the capacity for overloads was up to 2,500 I.H.P. Those engines were of the most modern type, and especially designed for this class of work, and manufactured by Messrs. Musgrave and Co., of Bolton. The fly-wheel alone of the engines weighed nearly 50 tons. The engines were lubricated by a modern system of automatic forced lubrication, and were of the cross-compound Corliss surface condensing type. They were supplied with steam from 10 Davey-Paxman boilers of the cylindrical marine type, and coal was conveyed from the barge to the boiler house without being touched by hand. The engine house had a 30-ton electric crane, by Messrs. Booth. Auxiliary engines were installed to ensure that the tunnels should always be lighted. These engines were of the Pesche type, by Messrs. Davey, Paxman. The boiler house was 60 ft. wide × 80 ft. long × 50 ft. high. The coal storage accommodation is for 1,000 tons, and that would enable them to have about a month's supply always on hand. The steel work had been all supplied by Messrs. Dorman, Long & Co. The roof of the buildings was slated and glazed before the side walls were erected. When they were approaching to what might be called the experimental working stage, it was the desire of the directors to invite the shareholders down to go over the railway and generating station. The mechanical stokers were made by Messrs. Vicars. The steam and feed piping are duplicated. The rails for the permanent way were all delivered on the spot, and in process of being laid. They were of novel and improved type, weighing 85 lbs. per yard, supplied by Messrs. Cammell & Co., of Sheffield. Special rolled steel chairs would support the rails; they were fixed every 2 ft. 6 in., and so would ensure an

elastic cushioned road, and would reduce the vibration to a minimum. The rolling stock was being constructed by the Electric Railway and Tramway Carriage Works, and by the Brush Electrical Engineering Company. The carriages were wider than any existing suburban carriages, being 9 ft. 4 in. wide over all, and 50 ft. long. Seven of the carriages go to form a train, three being motor carriages, equipped with six 125-H.P. motors. They are to be controlled on the multiple unit system. The seating capacity of the trains was 450 passengers, maximum. The electric lifts were made made by Messrs. Easton & Co. The directors were now considering the question of whether to open a section of the railway, or to wait until the short bit of line at the Finsbury end is completed, and the station made under the existing Finsbury Park Station of the G.N.R. Having referred to the company's Bill which has just been passed, and the question of the vibration clause introduced by the committees, the chairman moved the adoption of the report.

This was seconded by the Earl of Lauderdale, and carried unanimously.

Sir Hiram Maxim Electrical and Engineering Company.

The annual meeting of the above company was held at the works, Gillingham Street, S.W., on Thursday last week.

Mr. Jules de Meray, in moving the adoption of the annual report (copies of which were not obtainable by the Press), referred to the serious illness of Sir Hiram Maxim, and said he had instructed Mr. Wright, the manager of the contract department, and Mr. Hill, the manager of the lamp works, to prepare a report on their departments, and he would ask these gentlemen to read their reports.

Mr. Howard Wright said he had looked carefully into the position and prospects of the engineering department of the company, and he wished them in arriving at a correct idea of the true position to remember that the year 1901 was practically the first year's trading of his particular department, and they would recognise that in introducing a business of this special character a considerable time must always be allowed for laying down what he would term the foundation. Very rapid strides had been made in this direction, and he was inclined to think that few firms had accomplished so much in so short a time. The figures in the balance-sheet did not give a correct idea of the real amount of business done in the year, as most of the contracts were for large amounts, and they could not be taken fully into account until completed, but that state of things would be remedied after the first few years' working. The turnover taken into account in the balance-sheet amounted to about £20,000, while the orders not taken into account amounted to £69,000. In addition to these actual orders, they had in the last eight months sent in some 300 tenders, amounting to over £600,000. A number of these had not been settled, and in the natural course of things they would secure a certain proportion. In fact, in the case of one contract, involving about £180,000, they had a letter stating that out of four tenders received by the purchaser, theirs was by far the best scheme and would be approved, and that they would be asked shortly to prepare the necessary drawings and go fully into the details with a view to commencing the work. They had also under consideration several very large schemes in connection with electrical traction. Amongst the orders received might be mentioned contracts for the London County Council, Manchester Corporation, and the Local Authorities of Cardiff, Battersea, Hammersmith, Belfast, Wolverhampton, Islington, Hampstead, Worcester, Newport, Wakefield, and Leytonstone; for the Guernsey Electric Railway, the Charing Cross and City Electric Company, the Electrical Power Distribution Company, and the following firms:—Messrs. Babcock & Wilcox, Messrs. Ferranti, the Silvertown India-rubber Company, Messrs. Vickers, Sons & Maxim, Limited, Messrs. Crompton & Co., Messrs. Macartney, McElroy & Co., Messrs. Blackwell & Co., Ltd., and the Bengal Nagpur Railway Company. Many of these contracts had been completed, and in several cases where an official opening had taken place, their part of the work had been favourably commented upon in the press. Their work was highly spoken of at the opening of the Manchester new tramway station, which was the largest station in England, and the great speed with which this contract was carried out, had created a very favourable impression in several influential quarters. He might say that this department made it a first principle that all works must be of the very highest character both as regards design, workmanship and material, and the result of the policy was that the firm had already built up a reputation second to none in its specialities. As a proof of this in many cases contracts had been placed with them, even when their price was not the lowest, simply because the committee who was deciding the matter were convinced that they were getting good value for their money by placing the contract in their hands.

Mr. A. W. Hill said that in July, 1901, he was appointed works manager with instructions from the board to organise a factory capable of manufacturing 40,000 lamps, to provide for the contract entered into with the Lamp Company, and to accumulate a stock of all standard voltages and candle-power. They had now over half a million lamps in stock which enabled them to despatch orders at once. They had a first-class lamp works, and he had every confidence in saying they had a factory equipped with up-to-date machinery and special tools of every character, both for the efficient and economical manufacture of the best incandescent lamps upon the market. As regarded the cost of the manufacture of the lamps, there was considerable difficulty in making a comparison, but they were being manufactured now at least 3½d. per lamp cheaper than was the case some months ago. They did not, however, strive to make the cheapest lamp upon the market, but the best, in order to keep up their reputation. The first price would depend upon the number manufactured, for the factory was equal to turning out at least twice the number made at present with but a very small increase on the standing charges. On January 9th it was decided to cancel the concession to the Lamp Company, owing to a breach of the contract, and he was asked to undertake the commercial as well as the manufacturing operations, and he drew up price lists and catalogues and inserted advertisements in the leading technical papers. Up to that time the Lamp Company had done nothing in the way of advertising in the electrical papers. Travellers had been engaged, and numerous agents had been appointed. He might say that before this time in no case was the name of Maxim mentioned in the specification of large municipal bodies, but these authorities had been given the opportunity of testing their lamps, and these were now down on the lists of the War Office, the Indian Office, the London County Council, and most of the borough authorities. They had to record a steady increase in the number of customers. With regard to the future, he looked forward to a substantial increase of business.

The Chairman, commenting on the report made by Mr. Wright and Mr. Hill, paid a high tribute to the ability and enterprise displayed by these gentlemen, and proceeding, referred to the re-transfer of the agency of Messrs. J. F. Pease & Co., owing to the difficulty there was in arriving at a proper agreement as to the agency. He had before referred to new things they had in hand, and it was hoped soon to introduce a new arc lamp, which they believed, owing to its simplicity and small cost, would be very successful. In conclusion, he referred to the fact that the directors had waived their fees that year, and expressed the belief that the company would be ultimately very successful.

The Hon. W. F. B. Massey-Mainwaring seconded the motion.

A long discussion followed, and the accounts were severely criticised as well as the statements made in the prospectus.

Replying to various points raised, the Chairman said the board had paid £5,000 to the Lamp Company for shares under protest, but litigation was pending. It was true they took over the business of Edwards & Barnes, which they considered a good one, and which they got very cheaply. The item of £131,000 for the purchase of the concession and the works and business of the old company might appear a big item, but in the old company these items stood as an asset of £220,000. The compensation they received from Pease & Co. for the return of their agency was that Pease & Co. returned £5,000 of the company's shares and handed over £1,500 of their own shares and £750 in cash. With regard to the item of £30 for option of arc lamp, that would cost them nothing more, for it would be handed over to them on the basis of royalties to be paid, and if it was a success they would make a very good profit. The same explanation practically applied to the item of £130 for the automobile option. The whole of the capital had been called up, and was being paid in payments spreading over 15 months.

The report was adopted.

British Electric Transformer Manufacturing Company.

The fourth ordinary general meeting of the shareholders of the above company was held on Friday of last week at Dacre House, Victoria Street, S.W., Mr. R. Stewart Bain, C.A., presiding.

The Chairman, in proposing the adoption of the report, said the old proverb that "good wine needs no bush," might, he thought, appropriately be applied to the accounts and to that company. For three years in succession it had been his pleasure to recommend a dividend of 10 per cent. after putting aside provisions for reserve, depreciation, &c., equal to another 10 per cent. In the face of keen competition which existed in these days, and the talk of the British manufacturer being ousted by the foreigner, they at least had a machine, which was successfully holding its own against those attacks. The best proof that could be given of that, was their ability year by year to pay those substantial dividends, and not only to strengthen their positions financially by adding substantial amounts to their reserve fund, which was now equal to about 30 per cent. of the amount paid for their patents, but to strengthen it from a technical point of view by the aid of their adviser, the original inventor of their apparatus, who was not only able to keep abreast of the times, but with his keen intuition and inventive ability, anticipated the requirements of the industry, and by his new discoveries and adaptations kept adding to their existing patents, increasing their value and lengthening their duration. Many of the shareholders, he was glad to say, were scientific men and connected with the electrical industry, and were better able to judge of the merits of the transformer than he was, but when he was at the works on the previous day he had had an opportunity of inspecting some transformers built in accordance with their new patents. It was obvious even to a layman that the 1897 design had been greatly improved upon. The new transformers were more compact in form, and the mathematical lines in which they appeared to be constructed appealed to him, as he felt they must do to all of them who were engaged in that industry. He was of opinion that their new designs were as far in advance of their 1897 designs as those were in advance of the designs in existence then. He need only further point out that that meant they had added another four years to the life of their patents. In addressing them last year he mentioned that their new works at Hayes were nearing completion, and that they hoped to commence manufacturing in October. The actual commencement took place in November, and although that was in the midst of their busiest season, when their customers were pressing for delivery, they managed to move and increase the

output as well, although that increase would have been considerably greater if they had not been engaged in that important change. The machinery was taken down by degrees and put up at Hayes as it arrived, and the men to work it followed in suitable detachments; the stock of raw materials was distributed between the two places, and the staff for a time doubled itself, so to speak, and the result was no customer had to complain of delay. All their employés went with them, and were now settled down in their new quarters with benefit to themselves. In starting their works at Hayes they appeared to have set an example, as several other extensive works were now being erected, and cottages for workmen were being built. It was an advantage to a works to be surrounded by an industrial population. The new works had much better facilities for handling work than the old. The profit and loss account showed that, although they had that removal to contend with, their sales had increased by 12 per cent., as compared with last year, and their profit had increased from £6,658 to £7,194, which, with the amount carried forward, £1,960 14s. 11d., gave them an amount of £9,155 7s. 10d. to deal with. That enabled them to recommend the usual dividend, to set aside the usual amount to reserve fund, and to increase the amount carried forward. The balance-sheet, which he thought might be considered very satisfactory, showed that they had expended £452 18s. 11d. in additional patents. That amount included the cost of their applications for single and polyphase patents in nearly every country in Europe, as well as in America, Canada, and South Africa. It also included a new three-phase patent, which they had acquired during the year. The total expenditure on the new works, including freehold land, was £5,348 14s., or £657 6s. less than the estimate. That, as well as the economy and efficiency exercised in the removal of the works, they might attribute to the special attention and ability exercised by their manager, Mr. Hetherington. As to the present position of the company and its future prospects, he had already mentioned the keen competition they had to contend with. He was of opinion that that was likely to increase rather than decrease, but they believed that when efficiency was taken into account, they could sell as low as any manufacturer who worked on business lines, that was to say, who wished to make a profit. But to meet that competition and the steady increase in the growth of the business, it would be necessary to increase their capital. They were aware that the subscribed capital of the company was £20,000. They had carried on their works upon that comparatively small capital for three and half years. For three successive years they had paid a dividend of 10 per cent., and put aside £7,500 to a reserve fund, and they were carrying forward £2,600. In addition to that they had purchased freehold land upon which they had built their new works without increasing that capital, and further, they would see from the balance-sheet they had to carry debts due to them, amounting to over £12,000, principally from municipal corporations, whose practice it was to retain a percentage of their contracts for 12 months, as well as comparatively large stocks, and when they recollected that all that had been done on a subscribed capital of £20,000, out of which £5,000 was paid to the vendor, he thought they would all agree that they had done well; but they could not accomplish impossibilities, and they had now reached a period when if the company was to increase its output, and he trusted its profits, it would be necessary to raise more capital. They had not yet been in their new works quite nine months, and already the necessity for extensions was exercising their minds. Large power schemes in several parts of the country were now advanced so far as to be in the market for plant, and the transformers for these would be on a large scale, both as to numbers and output, and they should do their best to secure a good share of them at prices leaving a fair margin of profit. Then, again, station engineers with continuous current plant were now finding it advisable to lay down alternating plant alongside of continuous plant to enable them to reach the outlying parts of their areas or to supply districts outside, and some considerable work of that kind would be coming on shortly. For these reasons alone it would be necessary to increase their capital, but in addition to the reasons he had already mentioned, there was the question of dealing with their foreign patents. That was a matter which was now occupying the attention of the board. They believed that these foreign patents formed a very valuable asset, and it might be more to the advantage of the shareholders, that subsidiary companies should be formed in the various countries to work them rather than grant licenses. He need hardly point out that that was very largely a matter of capital. As they were aware, the authorised capital of the company was £50,000, of which £40,000 had been issued, leaving only £10,000 to be issued on the present capital. With the hopeful prospects in view he thought it was unnecessary to point out that the ultimate capital of the company must be considerably in excess of £50,000, but whether they decided to rest content for the present with issuing the £10,000 still remaining unissued, or to ask the shareholders to increase the nominal capital to a greater extent, largely depended upon circumstances. Whichever course was adopted, their interests were the first consideration of the board, and should it be found that the smaller increase would suffice for the present, it would be offered in the first place to the shareholders, probably at a small premium.

Mr. T. Petersen seconded the motion, and the report was agreed to.

National Telephone Company.

The thirteenth ordinary meeting of the shareholders of this company was held on Thursday last at Hamilton House, Victoria Embankment, W.C., Sir Henry Fowler, M.P., presiding.

In moving the adoption of the report, the Chairman said there were, on the whole, encouraging features in the accounts, and he hoped that the light in which the directors regarded the figures would be endorsed by the shareholders. The income which had accrued in respect of business during the past half-year was £821,743, and that compared with £774,714 in the corresponding half of 1901—an increase of £47,028. There had been a gradual increase of income in all their profit-earning departments. The working expenses for the half-year were £479,122, compared with £453,913 last year. Of course, an increase of income meant a corresponding addition to their working expenses, and although the directors were most anxious to keep the expenses down, the shareholders would understand that there were constant causes of increase—the wages, material, and other matters which they had to meet to the best of their ability. The net result of the half-year, deducting the Post Office royalties, which amounted to £75,577, was a profit balance of £267,043, as compared with £247,645 for the corresponding period of 1901, being an increase of £19,397. They would recollect that six months ago he called attention to the very serious snowstorm which occurred, and they put a considerable sum of money aside to meet the damage which resulted. They had now paid up everything in regard to it, but they had to provide an additional amount of £17,479, which would give them an idea of what an expensive calamity to the company a snowstorm was. The rentals carried forward for unexpired terms of running contracts amounted to £821,397 against £784,755 in the corresponding period of 1901. Out of the available balance of net revenue, amounting to £209,838, the directors recommended the payment for the half-year of a dividend at the rate of 6 per cent. per annum on the first and second preference shares, 5 per cent. on the third preference shares, 6 per cent. on the preference shares and preferred stock, and 4½ per cent. on the deferred stock, which was equivalent to 5 per cent. on the ordinary shares, now divided into preferred stock and deferred stock. Out of the income the board proposed to transfer £70,000 to the reserve fund; last year £65,000 was thus transferred. As their business increased and time ran on, and they became nearer and nearer to 1911, it was the duty of the directors, as it was their intention, to increase the reserve fund to the utmost of their power. The result of the figures he had placed before them was that the balance forward would be £8,588. With reference to the expenditure on capital account during the last half-year—viz., £303,029—it was much the same as the amount spent previously, and they had expended that capital in the 9,600 new lines. The number of lines on which capital was expended in the corresponding half-year was 7,393, so the shareholders would observe that with a very slight increase in capital expenditure they had made a considerable addition in the number of lines. On the maintenance and renewal of their lines and instruments they had spent £133,719, which was about £10,000 more than was spent under that head last year. The other expenses showed automatic increases in most cases and some were very satisfactory, as, for instance, the provision for the pension fund and interest on their reserve. The balance-sheet showed that they had now expended on capital account a sum in excess of what they had raised upon capital. When the balance-sheet was prepared they had still to receive a considerable amount in respect of the last issue of deferred stock and there was no necessity for their creating any further burden on the company. Taking all the circumstances into consideration, he thought the balance-sheet deserved their approval. With reference to the general position of the company, last year he told them that there had been an increase in London since the Post Office competition was established of 2,290 lines. They had had a very fair testing period as to the effect of that competition, and taking it from the time the competition began, which was November 18th last, he found that the increase of orders obtained in London amounted to 7,598, which was, he believed, as large an increase as they had had in any half year. He was sorry to say that in connection with that the public complained, it was natural they should, that their orders were not executed. They complained that the Post Office did not execute their orders sufficiently fast. Of the 7,500 orders of the company they had still 3,000 unexecuted, and they should proceed to execute them with the greatest possible speed. Under the circumstances he had stated he might repeat what he had said at the last meeting, that he had no fear of the competition of the Post Office. He was satisfied that it was not at present within the power of the Post Office or of that company, or of the two combined to supply the telephonic necessities of London. The whole matter was in the initial stage, and he repeated that until the Post Office was prepared to spend more money—and they had the nation's purse at their disposal—or until that company was in a position to do so, it would be impossible to meet the necessities of London. He was not talking of the provinces, but it would require a very large sum of money expended in London to meet all the requirements of the population, and provide the advantages which they were entitled to have. He should tell them that they were working most amicably with the Post Office. The rivalry which existed between the two bodies was simply a rivalry of accommodation, and both of them were doing their best to supply the public with what they required to the interest on the one hand of the revenue of the country, and on the other the legitimate interest of the shareholders of that company. There was only one other matter upon which he thought the shareholders would desire a little information, and that was in regard to the terrible fire which took place not a month ago in the City. He had not seen, himself, any fire connected with the company's buildings or works that compared with the ruin which that terrible fire created, and he would detain them while he read the official report of their manager of what he had done and was doing to repair the mischief that fire caused, and so that the least inconvenience possible might be caused to their customers. The

report stated:—"Fire started at 8 o'clock on night of Wednesday, July 9th, and by 10.30 the place was gutted. The same night it was decided to clear out the adjoining offices occupied by the company for the district engineering and instrument departments, and the same night reserve switchboards and other material were ordered by telephone from the Nottingham factory, and put on rail in trucks attached to passenger trains. That material was delivered and placed in the temporary exchange premises early on the next day (Thursday), other premises having been secured for the staff displaced, and the staff in the meantime moved into them. All men for whom work could be usefully found were collected from London and other parts of the country, and were divided into night and day gangs, and the work of fitting up the temporary boards and joining up with the outside work had proceeded day and night and on Sundays continuously, with the result that a large number of subscribers were connected each day, and the whole of the subscribers, some 2,600 in number, were got working again within 16 days from the time of the fire. The outside work was rendered difficult owing to the destruction of the records, and the fact that the derrick on the roof could not be used necessitated other arrangements to carry the cables. 100 new outside cables had to be erected, and for this purpose three double and six single poles had also to be erected to carry the cables, and in two cases piers had to be built and girders put in to support the poles. Upwards of 420 miles of outside wire and 334 miles of inside wire had to be put up. The satisfactory part of the business is that the new exchange, although, in a sense, a temporary one, will give a thoroughly efficient and good service." He spoke with some feeling upon that question, because he need hardly say that no credit was due to the board in connection with it, but to the general manager, the London engineer, the London superintendent, and all their subordinates, for the zeal, enthusiasm, and ability which they displayed in grappling with the calamity. All the board had done in the matter had been simply to fully insure their premises, and he hoped at the next half-yearly meeting he should not have to appeal for any consideration on account of the extra expense incurred in connection with the fire. On behalf of the board he wished to tender their thanks to their officers and men, who were as enthusiastic as their masters in dealing with the calamity.

Mr. Geo. Franklin seconded the motion, and the report was adopted.

In answer to a Shareholder, the Chairman stated that, as regarded wireless telegraphy, he did not think it had yet passed into the commercial atmosphere; but when it did, the board would, of course, have to take it into consideration.

Globe Telegraph and Trust Company.

The Marquis of Tweeddale, chairman, presided on Wednesday last week over the twenty-ninth annual meeting of the above company, held at River Plate House, and in moving the adoption of the report, said the accounts disclosed a very satisfactory state of things; their receipts, after deducting the usual expenses, amounted to £192,370, being an increase over the corresponding year of £2,234, and that enabled them to pay the usual preference dividend of 6 per cent., and a final dividend of 4s. 9d. on the ordinary shares, at the rate of 5¾ per cent., which was the best dividend the company had paid since its foundation 29 years ago, with the exception of the first year, when ¼ per cent. more was paid. They had issued 300 ordinary and 485 preference shares of the company under the powers conferred by the special resolution of 1875; the object being to take advantage of the low market price of certain shares of some of the best telegraphic companies, and those shares were acquired. The ordinary shares realised 11¼, while the price received for the preference shares ranged from 12½ to 14¼. In every case the proceeds were invested profitably, and the premium accounts of £1,536 had gone to reduce the item of "differences of securities realised," which was an item he dealt with fully last year. The shares were not offered to the shareholders, but were sold on the open market. With regard to these investments, there was a diminution in the receipts from the Anglo-American Telegraph Company of £860, due to the fact that in the March quarter that company paid 25s., instead of the usual 30s., on their preferred stock. It was satisfactory to know that at the last dividend they reverted to 30s., or 6 per cent. No doubt the Anglo-American Company suffered from the German competition in the Atlantic, but the traffic in the Atlantic was increasing continuously, and probably in the long run the companies would recover their position. The receipts from the Direct United States Cable Company showed a diminution of £497, which was also no doubt attributable to the same cause. As throwing light on the life of cables, it might interest the shareholders to know that although the Direct Company had only one cable, which had been working for 27 years, the electricians who had recently tested it reported that it was working as well as if it had only just been laid. He did not mean to infer that all cables were in that state, but he believed the average life of a cable, where great care had been exercised in placing it, was much greater than was anticipated when they commenced operations in submarine telegraphy. In the Submarine Cables Trust there was a slight diminution of £55, accounted for by the fact that a certificate had been drawn. They retained the coupon, which would no doubt go on increasing as more of the certificates were drawn. The interest on the debenture stock of the Western Telegraph Company was slightly smaller than last year, owing to their having sold £5,500 nominal, the proceeds of which had been invested in the shares of the same company. With regard to the West Coast of America Company, last year they held £16,600 nominal of the debentures, and these had all been sold except £600. The debentures, however, were at a lower price now than when they sold them. They had increased their holding in the Direct Spanish Company by 50 preference shares, but the dividend on these would come into next year's accounts. In the Eastern Telegraph Company they had purchased a further £1,500 nominal of ordinary stock, and the income from that company was £67,374, or a small increase of £29. They would have a large income from the new shares next year. In the Eastern Extension Telegraph Company there was a very considerable increase in their receipts, amounting to £5,293. Last year for a broken period they only received 2s. per share on the new shares allotted to them, while now they had received the full dividend of 7 per cent. The Telegraph Construction Company had once more reverted to its handsome dividend of 20 per cent. against 17½ per cent. last year, and that accounted for an increase of £1,094 in their receipts. They had so far received no dividend from the West African Telegraph Company, but the negotiations with the French Government had been satisfactorily concluded, and they might look forward to receiving some return on the shares they held, and this would be altogether to the good as they had received nothing for a good many years on account of the refusal of the French Government to pay what they had undertaken to pay. The chairman proceeded to deal with the proposal to in future make up the accounts to April 30th, so that the annual meeting might be held in May, which he thought would be convenient for all. While their dividends had been increasing during the last two or three years, the market value of their shares had somewhat suffered, and this was, no doubt, due to the threatened competition of wireless telegraphy. He had nothing to add to the remarks recently made by Sir John Wolfe Barry at the Eastern Telegraph Company's meeting, who thought wireless telegraphy would not interfere with submarine telegraphy, and certainly would not supplant it. Whether that opinion was well founded only time would show, but one fact to be noted was that telegraphic manufacturing companies never were more active in the manufacture of cables, both for the home and foreign Governments. Another matter of note was that the progress of wireless telegraphy was extremely slow, and nothing like what one might expect from the accounts they read from time to time in the press.

Sir James Pender, Bart., seconded the motion, and it was agreed to.

Crompton & Co., Limited.

Mr. John Trotter (chairman) presided on Wednesday last week at Salisbury House, London Wall, over the fourteenth annual general meeting of the above company, and, in moving the adoption of the report, said the real reason for the falling off in the profits was very simply explained, although the remedy was not quite so simple. By the examination of the figures before them they would see that the gross profits for the year amounted to £65,901 as against £68,633 last year. This result was disappointing, because the year under review had been one of singular activity, and one in which their sales had exceeded those of any previous year. In fact, the increase in the sales had been very satisfactory, as they exceeded by 7½ per cent. the sales in the previous year. Under these circumstances one would have hoped the gross profits would have risen correspondingly, but they had not done so. The trading expenses were £25,635, and the administrative expenses were £12,402. Both these expenses had risen, but an examination of the two items showed that they had only risen in a satisfactory degree. The two together amounted to an increase of 4 per cent. on those of the previous year, and inasmuch as the sales had risen 7½ per cent., the proportion showed that care had been exercised in the way money had been spent. They were lower relatively than last year. The real reason, therefore, was that the gross profit had decreased owing to competition prices. In the year concerned there certainly was a falling off in the demand for electrical appliances at one period, and that naturally caused manufacturers who were their competitors to seek at all hazards to keep up their output, and the consequence was the falling off in prices. If that had been all he did not think they would have had much to grumble at, but there had been exhibited during the year a kind of competition to which they had not been so much accustomed. There had been a large publicity given to all electrical enterprises, and there had been a great deal of speculation in new enterprises in the electrical world, and that had brought into the country, partly from abroad and partly from new starters, a large number of people who were investing large sums of money in electrical manufactures, and who were extremely anxious to obtain part of the market. For that purpose they were willing to compete at prices which Cromptons had no sort of intention of following, for they were prices which were not remunerative. They knew what the end of that would be, and therefore they were waiting to see this particular kind of competition removed. He was thankful to say that, thanks to the self-denial of the shareholders in years past, they were now in as comfortable a position to meet this class of competition as it was possible for them to be. There was another effect of this new departure in the electrical world. There had been a very great demand for expert electrical workmen and expert electrical officials, and many of their men had been tempted to leave them by offers elsewhere. Many had resisted the temptation, and he believed had done so in their own interest. Some, however, had gone from them, tempted by the large salaries offered elsewhere. The chief effect, so far as they were concerned, was that there had been a rise both in the salaries of officials and in the wages paid to workmen.

The market value had gone up, and they were obliged to pay more than they used to do for the same amount of intelligence and work. While it had been their policy to effect every economy possible, yet their efforts had been nullified by that increase in the cost of labour and salaries which had taken place in the year. It was satisfactory to find that they had been able to keep these things in ratio to the sales. Still, the price obtained for their output had not been so satisfactory as they could wish. Another fact was, that they had had to do more work to get their orders, for the percentage of orders to tenders sent in had been much lower than it used to be. The question which would interest them was whether this was a permanent or a temporary state of affairs. If he thought it was permanent, he would take a less sanguine view of the future than he did, but he thought it would pass away. They were not afraid of honest competition, and he thought the effect of the present keenness would show those engaged in the industry that it did not pay to work for nothing. There was no doubt that the nature of electrical enterprise had been rather more speculative than usual, and if a company wanted to share in those enterprises, they had to be content to take something besides cash. Their board had always set their face against taking paper in exchange for work which cost solid sovereigns, and, therefore, they found themselves cut off from that class of work where the contractors took securities for work done, and also the chance of unloading those securities on the market. He felt perfectly certain himself that in the long run that class of business would lead to disaster to those who embarked upon it. He might say that the slight diminution in the orders had to a certain extent passed away, and orders were coming in more quickly, although not so quickly as they would wish. Still they were beginning to come in better, and their order book was nearly full, although it was not so over-loaded as a year or two ago. He thought, therefore, they could look forward to the future with a certain amount of equanimity, as they felt their house was now in order. Some years ago they laid themselves out to remove the whole of the manufacturing premises, and to put their books in order, and those two objects had been thoroughly carried out. In the past year they had moved the whole of their lamp and instrument shops and their switchboard department from the old works into the new extension, and they were now in a position to manumanufacture as cheaply as anyone in the country. Turning to the balance-sheet, the chairman said that the capital was how fully paid up and settled, he hoped, for some time to come. Their creditors were £52,900, as against £67,000 last year, and the reserve and contingencies funds were much about the same as last year. On the other side, freehold land and premises stood at £55,900, as against £41,000, and the plant, tools, fittings, and fixtures £78,000, as against £68,000. The stock-in-trade and work in progress was £157,717, against £141,232, but relatively the figure had diminished. The increase was really due to the contract department, and was only of a temporary character. Trade debtors were £71,000, as against £80,000. The Chelmsford Electric Lighting Company absorbed £46,900, but that had now got into a satisfactory position, and it was altogether separate from Cromptons. Their patent account, which formerly stood at £5,658, had now been written down to practically nothing. They simply put it at £10 to remind them of the large amount it used to be. The goodwill remained at £10,000, and when they recollected the large figure at which it formerly stood, they could congratulate themselves on that.

Lieut.-Colonel Crompton, in seconding the motion, said they were well equipped to work economically, and consequently need not fear a time of low prices that had now set in, but which he believed had almost, if not quite, touched bottom.

The report was then agreed to.

The General Electric Company (1900), Limited.

The ordinary general meeting of the shareholders of this company was held on Thursday of last week at the Cannon Street Hotel, Mr. G. Byng presiding.

The Chairman said that before proceeding with the consideration of the report, he wished to address a few words to the shareholders on the terrible calamity which befell them in their Queen Victoria Street premises on June 9th last. It was most unfortunate that fate had singled them out to prove to what dangers they were exposed in the carrying out of their daily work. It was doubly hard upon the directors, because in the many years during which they had guided that undertaking, they had ever been mindful of their responsibilities towards those who worked with them. The business, as they knew, had constantly increased from year to year, and with it the number of their employés and workpeople, so that to-day they numbered nearly 5,000. They could imagine how great was the task of housing, organising, and looking after so many people, but he believed he was not wrong in saying that a proof of their having conscientiously carried out that task lay in the fact that during the 22 years' existence of their undertaking, they never, until this lamentable fire occurred, had to deplore the loss of a single life through a serious accident. It was easy after the event to inform them what might have been done, or what ought to have been done. Their premises in Queen Victoria Street had been inspected many times by fire experts, and on their recommendation they had spent hundreds of pounds upon a private fire brigade, hydrants, fire alarms, &c., but not one of those experts had ever recommended to them such a thing as, for instance, the placing of a permanent ladder in order to provide an exit to the roof. Whatever responsibility might be fastened upon them by the interpretation of one act or another, the directors felt that to the best of their ability they had taken every reasonable precaution for the safety of those, in the midst of whom they themselves were working daily. Being confident that the shareholders would endorse a policy which would tend to alleviate, as far as possible by monetary compensation, the suffering of those who had been injured, and the relatives of those who had lost their lives, they had already taken steps to carry out that policy in a generous spirit. He only wished to add that they had taken to heart the many lessons which the calamity had taught, and they hoped that others might also have profited by its lessons, and that the loss of precious lives might not have been in vain. Turning to the business of the day, the financial year of their balance-sheet, up to March 31st last, had, as regarded the general conditions of trade, suffered, as the previous one, from the continuation of the war, and the ever-increasing foreign competition to which manufacturers were exposed. Their organisations throughout the country had worked well, and considering all things, he thought they might consider the results of the year's working as satisfactory. The figures on the debit side of the balance-sheet differed slightly from those of last year. Only part of the capital was fully called up last year, and since then more ordinary shares had been allotted to members of the staff, who thus had become partners in the business. The income from investments was less compared to the previous year; one stock of the companies in which they were interested had passed its dividend last year, and they had written down the stock accordingly. Although their investments were put down at £47,400, these were made up of investments as figuring in their last year's balance-sheet to the amount of £39,000 and of £7,500 debentures in the Uxbridge Electric Lighting Company, acquired shortly before the close of this financial year. The following particulars would further explain why they could not yet yield any dividend during the present year. An influential local body in Uxbridge subscribed about £10,000 for the purpose of lighting the town, and offered them the contract under the condition that they supplied the remainder of the capital required. They estimated the total cost at about £22,000, and had undertaken the contract for the machinery and materials, taking in payment debentures with the option of exchanging them for ordinary shares. The installation was now working successfully, and promised soon to become a source of income. In connection with that Uxbridge undertaking, they had acquired a concession for the lighting of Northwood, West Drayton, and the district round Uxbridge, which was rapidly developing, and should prove of considerable benefit to their business. The current at Uxbridge was not only used for lighting, but they had already quite a respectable day-load for power. From an investment point of view, these debentures were well secured. The income of £3,700 upon the investment of £39,000 showed almost a return of 10 per cent., which must be considered to prove that their intrinsic value was fully up to the amounts at which they stood in their books. In fact, half the amount—nearly £18,000—were gilt-edged securities, forming an immediately available reserve. The remainder, a considerable amount, was represented principally by their share in the Incandescent Electric Lamp Factory, which had proved an excellent investment, both financially and commercially. The balance of appropriation brought down showed an increase of £11,000. The net result of trading was that they proposed to declare the same rate of dividend upon the ordinary shares as last year, but to place in reserve a sum of £3,000 in excess of that placed to this account last year. Sundry debtors and stock-in-trade stood at almost the same figures as last year, only about 4 per cent. more. They had increased their gross profit by 15 per cent. without appreciably increasing their stocks—a fact which, he thought, showed well for the general management of the business. The goodwill account stood at £92,000, and was the same as in last year's balance-sheet. That item was the only one in the balance-sheet not represented in a tangible form. It was the policy of the directors to build up a reserve fund to cover that item. The reserve fund now stood at £39,000, which was nearly half the amount standing against goodwill and patents, and he had no doubt that practice would meet with their approval. The increase shown under the heading of freehold land, buildings, &c., of £97,000, had almost entirely been expended for the purpose of developing their Witton estate and works. At Witton they had ample space for the largest possible works, and, what was more important, they could give their workpeople healthful surroundings, and provide means for their intellectual improvement and recreation. They had spared no expense to make those works complete and up-to-date. In the drawing offices and shops the machines and tools were all of the latest pattern, and there was no electrical work going in this country which they could not now undertake. The power house was finished, and a network of wires now supplied the whole estate with light and power. The second big works at Witton, now complete and in full swing, was their electric carbon factory, which practically represented a new industry in this country. So far no successful attempt had been made to produce in this country carbons for electric lighting that could compare in quality with those supplied from the Continent during the last 15 years. They had carefully considered the subject, and saw no reason why they, who prided themselves on being manufacturers of every electrical article, should not manufacture one of the most important articles of consumption. They had turned out carbons with raw material bought in this country, and every test that they and some of their customers had so far made, proved them to be in every respect equal or superior to any carbons they had handled during the last 15 years. They had found employment for an additional 200 hands, and had succeeded in training them for this new work. It would be premature in a free-trade country to predict financial success for those works; they did not know how far their foreign competitors might wish to fight them on their own ground. He believed that at the present moment very few people were aware that almost

every arc lamp in the streets of every town in the kingdom, every lamp in the docks or railway companies' stations, &c., every searchlight in a man-of-war, or used for the protection of our coasts, was lit with carbons imported from abroad; considering what possibilities might arise under those conditions, it was not quite out of place to appeal for support from public bodies at the commencement. He might add that the officials of the Admiralty had shown themselves alive to the importance of the new carbon factory, and had shown every desire to give them a fair chance. He had not said anything about their Manchester, Sherlock Street, Birmingham, and other works. Happy was the country that had no history, it spoke well of their old factories that there was but little to report—they had all done exceedingly well during the past year.

Mr. H. Hirst seconded the motion, and the report was adopted.

Charing Cross and Strand Electricity Supply Corporation.—The directors, after providing for debenture and other interest and dividend on preference shares, declared an interim dividend at the rate of 8 per cent. per annum for the half-year ended June 30th 1902, and carry forward £19,734. The registers for the preference and ordinary shares will be closed for the payment of dividends from August 2nd to August 16th.

Electric Welding Company.—The ordinary general meeting of the proprietors of this company was held last Friday at the offices of the company, 28, Basinghall Street, E.C.; but our representative was informed that the proceedings were private.

United River Plate Telephone Company.—Mr. George Keith, of the Cuba Submarine Telegraph Company, and chairman of the Chili Telephone Company, has joined the board of this company.

Schattner Electricity Meter Company.—The directors recommend a dividend of 6 per cent. for the year ending June 30th last.

TRAFFIC RECEIPTS.

Company.	Week ending	Receipts for the week.		Total to date.		Miles open.	
		Am'nt.	Inc. or dec.	Am'nt.	Inc. or dec.	This year.	Last year.
		£	£	£	£		
Blackburn Corp. Trys. ..	Aug. 1	843	+206	15,588	+ 3,012	—	—
Blackpool and Fleetwood	,, 2	1,188	—127	4,742	— 799	—	—
Bristol Trys. & Car. Co.	,, 1	4,847	+1,048	—	—	—	—
British Elec. Trac. Co.:—							
Devonport	July 25	474	+ 40	12,296	+ 403	5	5
Dudley—Stourbridge..	,, 25	829	+118	21,100	+ 2,987	18¾	18¾
Gateshead	,, 25	831	+200	20,789	+ 3,059	10½	9½
Greenock—Pt. Glasgow	,, 25	843	+623	14,067	+ 8,319	7¾	7¾
Hartlepool	,, 25	319	+ 39	7,060	+ 780	6½	4½
Kidderminster	,, 25	145	— 6	3,441	+ 28	4½	4½
Merthyr	,, 25	197	— 68	5,949	— 820	3	3
Middleton	,, 25	291	—	5,482	—	8½	—
Oldham—Ashton ..	,, 25	562	+ 50	15,139	+ 557	8	8
Poole	,, 25	259	— 1	6,946	— 100	3¾	3¾
Potteries	,, 25	1,484	— 10	42,498	+ 1,544	28¾	28¾
Southport	,, 25	342	+155	6,820	+ 2,375	5½	5½
South Staffordshire..	,, 25	769	— 40	22,707	+ 644	21½	22½
Swansea	,, 25	486	— 26	13,501	+ 1,397	5½	5½
Taunton	,, 25	68	—	1,780	—	1½	—
Tynemouth	,, 25	442	+ 51	7,681	+ 664	3½	3½
Wolverhampton Dist.	,, 25	333	+257	4,616	+ 3,049	10½	2½
Weston-super-Mare..	,, 23	260	—	2,196	—	2½	—
Central London Railway	Aug. 2	5,981	+302	33,572	+ 2,495	6	6
City and S. London Ry.	,, 3	2,697	+979	13,588	+ 4,320	6½	4½
Dover Corporation Trys.	,, 2	276	— 23	6,383	+ 150	3	3
Dublin United Trys. ..	,, 1	5,074	—289	23,540	— 636	46	46
East Ham Tramways ..	,, 2	491	+ 40	3,152	+ 440	5½	—
Glasgow Corp. Trys. ..	,, 2	11,167	—1,177	104,744	— 4,449	53¾	44½
Liverpool Overhead Ry.	,, 3	1,694	— 55	8,067	— 588	6½	6½
Newcastle Corp. Trys. ..	,, 2	2,924	—	—	—	—	—
Sunderland Corp. Trys.	--	—	—	—	—	—	—

STOCKS AND SHARES.

Wednesday Evening.

Stock Exchange matters are not the rosiest things to write about this week. Depression is the order of the day in most departments of the House, depression caused principally by lack of business, although other reasons of more specific character are advanced where the dulness is most supreme. Consols certainly cannot complain of the money market, since the indebtedness of Lombard Street to the Old Lady is gradually becoming reduced and without any difficulty. Yet the funds have fallen below 95, and the price, cheap as it now appears, is talked still lower in several quarters. Another severe spasm of weakness in the Kaffir Circus is tending to lower quotations in directions which, while they have no actual connection with South African shares, are none the less affected by the well-known sentimental feeling which governs markets as a whole. Add the August holiday spirit which is abroad, and the wonder is that stocks and shares commanding a limited market are able to present a united front of any sort.

The Electricity Supply list, however, is steady to good. Changes are few, but what there are show hopefully against the deadly dulness of other sections. County of London and Brush Ordinary are better to the extent of 10s. Edmundson's Ordinary have put on ¼, and a similar rise is shown by London Electric Preference. The latter shares changed hands the other day at 4⅞. A buyer of City of London Preference had to pay the top price of 12½, there being comparatively few good Preferences in the market. Westminster Preference are 6, Charing Cross new Ordinary at 8½ keep steadily at about £1 below the price of the former issue.

As regards Provincials, Folkestones are 6 and Oxfords 5½, while Bournemouth and Poole Ordinary have 12 for their medium price, the £10 Preference shares being just par. Hove Electric rarely changes from 7½. Going out of the country, Electric Lighting and Traction of Australia Preference are 4½, and the Debentures a shade over par. Calcutta Electric keep at 8 to 9. Central Electric 4 per cent. Debenture, by the way, is firmly established at 106.

General Electric Preference at 10 and the 4 per cent. Debenture stock at par, are unaffected by the severe strictures recently passed upon the company in connection with the City fire. Electrolytic Alkali Ordinary at ⅞ and the Preference at ⅛ higher are difficult of negotiation, but then, of course, most industrial descriptions nowadays may be included under the same statement. Brush second Debenture has shed a point, otherwise our list of miscellaneous ventures is practically unchanged.

Sir Henry Oakley's interesting speech at the meeting of the Central London Railway on Tuesday produced no immediate effect upon the prices of the stocks, and, considering the cautious vein in which it was couched, the indifference of prices is not wonderful. Obviously the Twopenny Tube has not overcome all its initial difficulties even yet, but with the delivery of the new motor cars in October there will probably be less heard of the vibration difficulty. Waterloo & City stock is also unaltered, despite the appearance of a healthy report, which shows a drop in the ratio of working expenses of a round 10 per cent.—a remarkably good performance. City and South London is quiet after the recent excitement. Those inquisitive people who always want to know everything in advance are asking whether the new electric tramway system that is to be installed in South London may not prejudicially influence the traffics of the pioneer electric railway. City third Preference, for which an inquiry sprang up two or three weeks ago, has tapered off a little to 123½ *ex* dividend, which must still be regarded as a good price, equal as it is to 126 *cum*.

Flirtation with electric traction on the part of the leading railway companies in the kingdom has passed into more serious wooing. The North-Eastern—most enterprising of all the steam lines—is experimenting in very practical fashion on a short branch line. The Brighton is keenly alive to the necessity for having electrical reasons of its own to show as evidence that competitive undertakings are not wanted in its district. The Great Eastern holds aloof, though its densely-populated line must one day yield to the coming power. At nearly all the railway meetings which have been held this question of electric traction has formed a leading theme for the chairman to dilate upon. Metropolitan Consolidated has improved to 83 upon the statement that the electrification will be completed at an earlier date than the market at first expected. Districts are a fraction over 32.

Telegraph stocks are a trifle irregular. Whereas Eastern Extension shares show a decline of ½, Indo-Europeans are £1 better, and Globe Telegraph Ordinary have advanced to 9½. A few of the Debentures in this section are quoted *ex* the interest which fell due last week. West India and Panama Debentures are up 2 points; West African Telegraph shares remain at 4 and the Debentures at 101½. Cuba Ordinary strengthened to 5½ at the enterprising way in which the island is going ahead, and possibly even the two heavy new loans which are spoken of as likely to be made by Cuba will indirectly minister to the benefit of her commerce.

It is very difficult for holders of Debentures in the Blackpool Electric Tramways (South), Limited, to know what to do in the present condition of affairs. The problem is, shortly, whether it be better to wind-up the company altogether, or to trust to new management to raise the undertaking into a position in which it may at least have some hope of profit making. The trustees appear to think that the property is valuable, but the Debenture holders are to have an opportunity for exchanging views at the meeting which was convened last week.

A somewhat singular promotion is that called the South Yorkshire Promoters, Limited. Its capital is £99, and its aims are to supply electricity of nearly every description in the West Riding of the champion cricket county. Further developments will be awaited with interest.

SHARE LIST OF ELECTRICAL COMPANIES.—TELEGRAPH AND TELEPHONE COMPANIES.

Present Issue.	NAME.	Stock or Share. ‡	Dividends for the last three years. 1899.	1900.	1901.	Closing Quotation July 30th.	Closing Quotations Aug. 6th.	Business done during week ended Aug. 6th, 1902. Highest.	Lowest
82,300	African Direct Telegraph, 4 % Debs.	100	...	...	...	98 —102	98 —102	...	...
25,000	Amazon Telegraph Co.'s shares, Nos. 1 to 25,000	10	...	...	...	3½— 4½	3½— 4½	...	...
119,700£	Amazon Telegraph 5 % Debs., Nos. 1 to 1,250 Red. ...	100	...	...	...	70 — 80	70 — 80	...	...
804,720	Anglo-American Telegraph	Stock	73/6	3½%	61s.	45 — 48 xd	45 — 48 xd	45½	...
3,097,640	Do. do. 6 % Pref.	Stock	6 %	6 %	6 %	89 — 91 xd	89 — 91 xd	90⅜	89
3,097,640	Do. do. Deferred	Stock	£1 7s.	5s.%	2s.	6½— 7	6½— 7	6¼	...
44,000	Chili Telephone, Nos. 1 to 44,000	5	4 %	5 %	5%	3½— 4 xd	3½— 4 xd	...	...
13,333,300$	Commercial Cable	$100	8 %	...	...	165 —170	155 —165	169½	...
1,741,029£	Do. do. Sterling 500 year 4 % Deb. Stock Red.	Stock	...	...	...	95 — 97	95 — 97	96⅝	95½
16,000	Cuba Telegraph	10	7 %	...	...	4½— 5½	5 — 6	...	...
6,000	Do. 10 % Pref.	10	...	...	...	12½— 13½	12½— 13½	...	...
12,931	Direct Spanish Telegraph	5	4 %	4 %	...	2½— 3½	2½— 3½	...	...
6,000	Do. do. 10 % Cum. Pref.	5	...	...	...	7½— 8½	7½— 8½	...	...
60,710£	Direct United States Cable	20	3½%	3½%	3½%	10 — 11	10 — 11	10 7/16	...
96,300	Direct West India Cable, 4½ % Reg. Deb., within Nos. 1 to 1,200, Red.	100	...	...	...	99 —102	99 —102	...	...
4,000,000	Eastern Telegraph, Ord. Stock	Stock	7 %	7 %	7 %	117 —127	120 —130	121	118
1,930,807	Do. 3½ % Pref. Stock	100	...	...	...	87 — 90	87 — 90	...	...
1,432,268£	Do. 4 % Mort. Deb. Stock Red.	Stock	...	...	...	108 —112	108 —112	108½	...
300,000	Eastern Extension, Australasia, and China Telegraph ...	10	7 %	7 %	7 %	12 — 13	11½— 12½	12	11 9/16
320,000£	Do. 4 % Deb. Stock	Stock	...	...	...	108 —113	107 —112 xd	109	108⅝
300,000£	Eastern and South African Telegraph, 4 % Mort. Deb. Nos. 1 to 3,000, red. 1909	100	5½%	...	...	100 —103	100 —103	...	...
200,000£	Do. 4 % Reg. Mt. Debs. (Mauritius Sub.) 1—8,000	25	...	...	...	100 —103	98 —101 xd	...	...
180,227	Globe Telegraph and Trust	10	5½%	5½%	...	8½— 9½	8½— 9½	9⅜	9⅛
180,042	Do. do. 6 % Pref.	10	...	...	...	12½— 13½	12½— 13½	13⅛	13 3/16
150,000	Great Northern Telegraph, of Copenhagen	10	...	15 %	...	25 — 27	25 — 27	...	...
70,000	Halifax and Bermuda Cable, 4½ % 1st Mort. Debs., within Nos. 1 to 1,200, Red.	100	...	...	...	99 —102	99 —102	...	...
17,000	Indo-European Telegraph	25	10 %	10 %	10 %	37 — 41	38 — 42	38⅜	38½
100,000£	London Platino-Brazilian Telegraph, 6 % Debs.	100	...	...	...	101 —105	101 —105	...	...
72,680	Montevideo Telephone, Limited, Ord., Nos. 1 to 72,680 ...	1	2½%	...	...	½— ½	½— ½	...	...
86,492	Do. do. do. 5 % Pref., Nos. 1 to 86,492	1	5 %	...	...	⅝— 1	⅝— 1	...	...
983,333	National Telephone, Pref. Stock	100	5 %	5 %	5 %	95 — 99	95 — 99	97½	...
200,000	Do Pref. shares	2	...	3½	3⅜	4⅜— 4⅞	4⅜— 4⅞	...	...
1,966,667	Do Def. Stock	100	...	60	64 xd	56 — 60	56 — 60	59	...
15,000	Do. 6 % Cum. 1st Pref.	10	6 %	6 %	6 %	12 — 14	12 — 14	...	...
15,000	Do. 6 % Cum. 2nd Pref.	10	6 %	6 %	6 %	11 — 13	11 — 13	...	...
250,000	Do. 5 % Non-cum. 3rd Pref., 1 to 250,000	5	5 %	5 %	5 %	4⅞— 5⅛	4⅞— 5⅛	...	...
2,000,000£	Do. 3½ % Deb. Stock Red.	Stock	3½%	3½%	3½%	95 — 98	95 — 98	95⅜	...
500,000£	Do. 4 % Deb. Stock Red.	100	...	4 %	4 %	102 —106	102 —106	104⅜	102½
171,504	Oriental Telephone and Elec., Nos. 1 to 171,504, fully paid	1	5 %	6 %	6 %	1 1/16— 1 1/16	1 1/16— 1 1/16	...	...
100,000£	Pacific and European Tel., 4 % Guar. Debs., 1 to 1,000 ...	100	...	...	...	99 —102	99 —102	...	...
11,839	Reuter's...	8	5 %	5 %	...	6½— 7½	6½— 7½	...	...
3,303	Submarine Cables Trust	Cert.	...	...	...	110 —120	110 —120	113½	...
58,000	United River Plate Telephone	5	7 %	...	...	4⅜— 5⅛	4⅜— 5⅛	...	...
40,000	Do. do. 5 % Cum. pref. Nos. 1—40,000	5	...	...	...	4½— 5	4½— 5	4⅝	...
179,947£	Do. do. 5 % Debs.	Stock	...	...	...	101 —104	101 —104	...	...
155,600	West African Telegraph, 5 % Debs....	100	...	...	...	100 —103	100 —103	...	...
80,008	West Coast of America, Nos. 1—30,000 and 53,001—53,008	2½	...	...	...	⅛— ⅜	⅛— ⅜	...	...
150,000£	Do. do. 4 % Debs., 1—1,500 gua. by Bras. Sub. Tel.	100	...	...	...	97 —100	97 —100	...	...
207,930	Western Telegraph, Ltd., Nos. 1—207,930	10	7 %	7 %	...	11½— 12½	11½— 12½	...	...
75,000£	Do. do. 5 % Debs. 2nd series, 1906 ...	100	...	...	...	101 —104	101 —104	...	...
348,777£	Do. do. 4 % Deb. Stock Red.	100	...	...	...	97 —100	97 —100	...	...
88,321	West India and Panama Telegraph	10	5%	...	...	¼— ½	¼— ½	...	...
34,563	Do. do. do. 6 % Cum. 1st Pref. ...	10	...	...	...	4½— 5½	4½— 5½	5	4 13/16
4,669	Do. do. do. 6 % Cum. 2nd Pref. ...	10	...	...	...	3 — 4	3 — 4	...	...
80,000£	Do. do. do. 5 % Debs., Nos. 1 to 1,600	100	...	...	...	97 —100	99 —102	...	...

ELECTRICITY SUPPLY COMPANIES.

100,000	Blackheath and Greenwich Dist. Electric Light, Ord. ...	1	...	...	...	¼— ⅜	¼— ⅜	...	...
100,000	Do. 4½% 1st Deb. Stock, Prov. Certs.	100	...	...	...	103 —106	103 —106	...	...
19,661	Brompton & Kensington Elec. Lt. Sup., Ord., 101 to 19,761	5	6 %	6 %	8 %	9¼— 9⅜	9¼— 9⅜	...	...
20,000	Do. do. 7 % Cum. Pref....	5	...	...	..	9¼— 9⅜	9¼— 9⅜	...	...
50,000	Charing Cross and Strand Electricity Supply	5	9 %	9 %	10 %	9 — 10	9 — 10	...	...
50,000	Do. do. do. do. 4½% Cum. Pref.	5	...	...	...	5¼— 5⅜	5¼— 5⅜	...	...
250,000	Do. do. do. 4% Deb. Stock Red.	100	...	...	...	105 —107	106½—105½	...	...
34,000	*Chelsea Electricity Supply, Ord.	5	6 %	5½%	4 %	5¼— 5⅜	5¼— 5⅜	...	...
150,000£	Do. do. do. % Deb. Stock Red. ...	Stock	...	...	...	109 —112	109 —112	110	...
70,579	City of London Electric Lighting, Ord. 40,001—110,579...	10	4 %	0 %	5 %	8½— 9½	8½— 9½	9 5/16	...
40,000	Do. 6 % Cum. Pref., 1 to 40,000	10	6 %	6 %	...	11½— 12½	11½— 12½	12½	...
400,000£	Do. 5 % Deb. Stock, Scrip. (iss. at £115) all paid	...	...	...	...	122 —127	122 —127	...	...
200,000	Do. 4½% 2nd Deb. Stock, Prov. Certs., all paid	100	...	...	...	101 —104	101 —104	102½	...
40,000	County of Lond. & Brush Prov. Elec. Ltg., Ord. 1—40,000	10	4 %	4 %	4 %	8 — 9	8½— 9⅛	9⅛	...
20,000	Do. do. do. 6 % Pref., 40,001—60,000	10	6 %	6 %	...	11½— 12½	12 — 12⅝	12 5/16	...
400,000£	Do. 4½ % Deb. Stock, Prov. Certs (all paid) Rd. ...	...	...	...	...	109 —112	109 —112	...	...
35,500	Edmundson's Elec. Corp., Ord. Shares	5	6 %	7 %	7 %	6 — 6½	6½— 6⅝	6½	...
20,000	Do. do. 6 % Cum. Pref.	...	...	...	...	6 — 6½	6 — 6½	...	...
120,000£	Do. do. 4½ % 1st Mort. Deb. Stock. ...	100	...	...	...	105 —108	106 —109	...	...
21,000	Kensington and Knightsbridge Electric, Ord.	5	11%	12%	10%	10 — 11 xd	10 — 11	10⅜	...
90,000	Do. do. do. 4 % Deb. Stock	Stock	...	...	...	101 —104	101 —104	...	...
110,000	London Electric Supply Corporation, Limited, Ord. ...	3	...	...	...	1½— 1⅝	1½— 1⅝	...	...
49,840	Do. do. do. do. 6 % Pref.	5	...	...	...	4 — 4½	4 — 4½	4⅝	...
250,000£	Do. do. do. 4% 1st Mt. Db. Stock Rd.	Stock	...	...	...	94 — 99	94 — 99	96	95⅞
98,769	Metropolitan Electric Supply, 101 to 62,500	10	5 %	6 %	6½%	15½— 16½	15½— 16½	...	...
220,000£	Do. 4½% First Mortgage Debenture Stock	...	...	...	...	108 —112	108 —112	...	...
250,000£	Do. 3½% Mort. Deb. Stock Red.	Stock	...	...	...	98 —101	98 —101	...	...
8,652	Notting Hill Electric Lighting	10	7 %	7 %	6 %	13½— 14½	13½— 14½	...	...
40,000	St. James's and Pall Mall Electric Light, Ord.	5	14½%	14½%	14½%	14½—15½xd	14½— 15½	...	...
20,000	Do. do. 7 % Pref., 20,081 to 40,080	5	7 %	7 %	7 %	8½— 9½xd	8½— 9½	...	...
150,000£	Do. do. 3½ % Deb. Stock Red. ...	100	...	...	...	97 —100	97 —100	...	...
12,000	Smithfield Market Elect. Supply, Ord.	5	...	...	...	1⅝— 2⅛	1⅝— 2⅛	...	...
50,000£	Do. do. 4 % Deb.	100	...	...	...	80 — 90 xd	80 — 90 xd	...	...
65,000	South London Electricity Supply, Ord.	5	...	...	...	2½— 3	2½— 3	...	...
109,518	Westminster Electric Supply, Ord.	5	13 %	10½%	10½%	10½ - 11½xd	10½ - 11½xd	11⅛	...

* Subject to Founders Shares. † Quotations on Liverpool Stock Exchange.
Unless otherwise stated all shares are fully paid. ‖ Dividends paid in deferred share warrants, profits being used as capital.
Dividends marked are for a year, consisting of the latter part of one year and the first part of the next.

SHARE LIST OF ELECTRICAL COMPANIES.—*Continued.*

ELECTRICAL RAILWAY, MANUFACTURING, AND INDUSTRIAL COMPANIES.

Present Issue.	NAME.	Stock or Share.	Dividends for the last three years. 1899.	1900.	1901.	Closing Quotation July 30th.	Closing Quotation August 6th.	Business done week ended Aug. 6th, 1902. Highest.	Lowest.
20,000	British Aluminium 7 % Cum. Pref.	10	...	...	...	4 — 5	4 — 5	...	...
300,000£	Do. do. 5 % 1st Mort. Deb. Stock Red. ...	Stock	...	...	...	83 — 88	83 — 88	...	...
62,074	British Electric Traction	10	8 %	9 %	9 %	12⅜— 13¼	12⅜— 13⅜	13⅜	12⅞
90,000	Do. do. 6 % Cum. Pref.	10	...	...	...	12¼— 12¾	12½— 13	12⅝	12⅜
600,000£	Do. do. 5 % Perpetual Debenture Stock ...	Stock	...	...	...	124 —127	124 —127	126	125½
70,000	British Insulated Wire Ord.	5	20 %	15 %	10 %	7½— 7⅝	7½— 7⅝	...	...
70,000	Do. do. 6 % Cum. Pref.	5	...	...	...	5¼— 5⅜	5¼— 5⅜	...	...
50,000	¶Browett, Lindley & Co. (1899), Ord.	£1	...	8 %	...	13s. to 15s.	13s. to 15s.	...	...
50,000	¶ „ „ „ 6 % Cum. Pref.	£1	...	6 %	...	16/6 to 17/0	16/6 to 17/0	...	...
105,731	Brush Elecl. Enging., Ord., 1 to 105,731	2	5⅛ %	5 %	Nil	1⅛— 1⅜	1⅛— 1⅜	...	...
150,000	Do. do. Non-cum. 6 % Pref.	2	6 %	6 %	3 %	1½— 2	1½— 2	...	...
125,060£	Do. do. 4½ % Perp. Deb. Stock	Stock	...	...	...	102 —105	102 —105	105	104
125,000£	Do. do. 4½ % Perp. 2nd Deb. Stock ...	Stock	...	...	...	95 —100	93 — 98	...	...
30,000	Callender's Cable Construction shares, Nos. 1—30,000 ...	5	15 %	15 %	20 %	15½— 16½	15½— 16½	...	...
40,000	Do. do. 5 % Cum. Pref.	5	...	...	...	5½— 6	5½— 6	...	...
90,000£	Do. do. 4½ % 1st Mort. Deb. Stock Red ...	Stock	...	...	...	109 —113	109 —113	...	...
1,969,800	Central London Railway, Ord. Stock	Stock	...	...	4 %	105 —108	105 —108	107	106½
440,100	Do. do. 4 % Pref. Stock	Stock	...	...	4 %	106 —109	106 —109	...	...
440,100	Do. do. Def. do.	Stock	...	...	4 %	103 —106	103 —106	104½	104¼
855,000	City and South London Railway	Stock	1⅞%	1½%	2 %	71 — 73 xd	71 — 73 xd	73	71
54,000	Crompton & Co., Nos. 1 to 54,000	3	7½%	8 %	...	2¾— 3¼	2¾— 3¼	2 11/16	...
100,000£	Do. 5 % 1st Mort. Reg. Debs., 1 to 900 of £100, and 901 to 11,000 of £50 red	...	...	...	...	101 —106 %	101 —106 %	...	...
99,261	Edison & Swan Utd. El. Lgt., "A" shares, £3 pd. 1 to 99,261	5	6 %	2⅛%	...	⅛— ⅜	⅛— ⅜	...	...
17,139	Do. do. do. "A" Shares, 01—017,139 ...	5	6 %	2⅛%	...	1½— 2⅛	1½— 2⅛	...	...
344,023£	Do. do. do. 4 % Deb. Stock Red ...	100	...	...	...	74 — 78	74 — 78	...	...
100,000£	Do. do. 5% 2nd Deb. Stock Prov. Certs. all pd.	100	...	...	...	82 — 86	78 — 83	...	...
112,100	Electric Construction, 1 to 112,100	2	6 %	6 %	6 %	1½— 2	1½— 2	...	...
31,390	Do. do. 7 % Cum. Pref., 1 to 31,390... ...	2	...	...	...	2½— 3	2½— 3	...	...
182,500£	Do. do. 4 % Perp. 1st Mort. Deb. Stock ...	Stock	...	...	...	97 —100	97 —100	...	...
18,000	General Elec. Co. (1900) 5 % Cum. Pref.	10	...	...	...	9⅞—10¼	9⅞— 10¼	10	9 13/16
150,000	Do. do. 4 % Mort. Deb.	Stock	...	...	...	99 —102	99 — 102	...	...
35,000	Henley's (W. T.) Telegraph Works, Ord.	5	15 %	20 %	20 %	16 — 17	16 — 17	16¼	...
35,000	Do. do. do. 4½ % Pref.	5	4½%	4½%	...	5⅛— 5⅜	5⅛— 5⅜	...	...
50,000£	Do. do. do. 4½ Mort. Deb. Stock...	Stock	...	...	...	111 —115	111 —115	...	...
50,000	India-Rubber, Gutta-Percha and Telegraph Works ...	10	10 %	10 %	...	20½— 21½	20½— 21½	20½	...
300,000£	Do. do. do. 4 % 1st Mort. Deb	100	...	...	...	100 —103	100 —103	...	...
37,500	†Liverpool Overhead Railway, Ord.	10	3½%	3½%	1½%	4½— 4⅝	4½— 4⅝	...	...
10,000	† Do. do. Pref., £10 paid	10	5	...	...	10 — 10½	10 — 10½	...	...
7,500	Parker (Thomas), Limited, Ord., Nos. 1 to 7,500	10	...	...	...	14½— 15½	14½—15½	...	...
	§Rosling & Fynn 6 % Cum. Pref.	£1	...	6 %	...	... — ...	19/0 to 20/0	...	...
37,350	Telegraph Construction and Maintenance	12	15 %	17½%	20 %	36 — 39	36 — 39	38	36½
150,000£	Do. 4 % Deb. Bds. Nos. 1 to 1,500 Red. 1909 ...	100	... %	...	...	102 —105	102 —105	...	...
25,000	Telegraph Manufacturing, Ord. Nos. 1 to 25,000	5	12 %	12 %	...	9½— 10½	9½— 10½	...	...
20,000	Do. do. 5 % Cm. Prf. Nos. 1 to 20,000...	5	...	...	...	5⅛— 6	5⅛— 6	...	...
540,000£	Waterloo and City Railway, Ord. Stock	100	3 %	3 %	3 %	92 — 95	92 — 95	...	...

† Quotations on Liverpool Stock Exchange. ‡ Unless otherwise stated all shares are fully paid. § From Bradford Share List.

LATEST PROCURABLE QUOTATIONS OF SECURITIES NOT OFFICIALLY QUOTED.

Consolidated Telephone Construction and Maintenance, ⅞—1⅛.
National Electric Free Wiring, —1.

Oldham, Ashton, and Hyde Electric (£10 pd.), Ord., 14½—15.
Do. do. Pref. (£10 pd.), 10⅜—10⅝.

* From Birmingham Share List. ¶ From Manchester Share List.

Bank rate of discount 3 per cent. (February 6th, 1902).

MARKET QUOTATIONS, Wednesday, August 6th.

CHEMICALS, &c.		This week.	Last week.	Inc. or Dec.
a Acid, Hydrochloric	per cwt.	5/-	5/-	..
a „ Nitric	per cwt.	22/-	22/-	..
a „ Oxalic	per cwt.	32/-	32/-	..
a „ Sulphuric	per cwt.	5/6	5/6	..
a Ammoniac, Sal	per cwt.	42/-	42/-	..
a Ammonia, Muriate (crystal) ..	per ton	£88 10	£88 10	..
a „ „ „	per ton	£90	£90	..
a Bleaching powder	per ton	£7	£7	..
a Bisulphide of Carbon	per ton	£15	£15	..
a Borax	per ton	£18	£18	..
a Benzole (90 %)	per gal.	7/-	7/-	..
a „ (50/90%)..	per gal.	5/6	5/6	..
a Copper Sulphate	per ton	£19	£19	..
a Lead, Nitrate	per ton	£24	£24	..
a „ White Sugar	per ton	£31	£31	..
a „ Peroxide	per ton	£27 10	£27 10	..
a Methylated Spirit	per gal.	2/6	2/6	..
a Naphtha, Solvent (90% at 160° C),	per gal.	5/6	5/6	..
a Potash, Bichromate, in casks..	per lb.	5d.	5d.	..
a „ Caustic (76/80%) ..	per ton	£24	£24	..
a „ Bisulphate	per ton	£25	£25	..
a Shellac	per cwt.	106/-	106/-	..
a Sulphate of Magnesia	per ton	£4 10	£4 10	..
a Sulphur, Sublimed Flowers ..	per ton	£6 5	£6 5	..
a „ Recovered	per ton	£5 10	£5 10	..
a „ Lump	per ton	£5	£5	..
a Soda, Caustic (white 70 %) ..	per ton	£10 15	£10 15	..
a „ Crystals	per ton	£8	£8	..
a Bichromate, casks ..	per lb.	2¼d.	2¼d.	..
METALS, &c.				
b Aluminium Ingots, in ton lots	per ton	£148	£148	..
b „ Wire, in ton lots	per ton	£224	£224	..
b „ Sheet, in ton lots	per ton	£191	£191	..
p Babbitt's metal ingots.. ..	per ton	£40 to £140	£40 to £140	..
c Brass (rolled metal 9" to 12") basis	per lb.	6¾d.	6¾d.	..
c Tube (brazed)	per lb.	8¾d.	8¾d.	..
c „ „ (solid drawn) ..	per lb.	7d.	7d.	..
c „ Wire, basis	per lb.	7d.	7d.	..
c Copper Tubes (brazed) ..	per lb.	8¾d.	8¾d.	..
c „ „ (solid drawn) ..	per lb.	9d.	9d.	..
g Copper Bars (best selected) ..	per ton	£69	£69	..

METALS, &c, *(continued.)*		This week.	Last week.	Inc. or Dec.
g Copper Sheet	per ton	£69	£69	..
g „ Rod	per ton	£69	£69	..
c „ Electrolytic) Bars ..	per ton	£63	£63	..
c „ „ Sheets ..	per ton	£75	£75	..
c „ „ Rod ..	per ton	£68	£68	..
c „ „ H.C. Wire	per lb.	8d.	8d.	..
f Ebonite Rod	per lb.	8/-	8/-	..
f „ Sheet	per lb.	5/-	5/-	..
n German Silver Wire	per lb.	1/5	1/5	..
h Gutta-percha fine	per lb.	8/-	8/-	..
h India-rubber, Para fine	per lb.	2/11½ to 3/-	2/11½ to 3/-	..
i Iron, Charcoal Sheets	per ton	£18	£18	..
i „ Pig (Cleveland warrants) ..	per ton	51/-	51/1	1d. dec.
i „ Forgings, according to size	per ton	From £11	From £11	..
i „ Scrap, heavy	per ton	47/6 to 50/-	47/6 to 50/-	..
i „ Wire, galvanised No. 8 ..	per ton	£9 15	£9 15	..
g Lead, English Ingot	per ton	£11 5 to £11 7 6	£11 5 to £11 7 6	..
g „ „ Sheet	per ton	£13	£13	..
m Manganin Wire No. 28	per lb.	8/-	8/-	..
g Mercury	per bott.	£8 15	£8 15	..
d Mica (in original cases), small ..	per lb.	8d. to 9d.	8d. to 9d.	..
d „ „ „ medium	per lb.	1/9 to 2/9	1/9 to 2/9	..
d „ „ „ large ..	per lb.	3/8 to 7/8	3/8 to 7/8	..
p Phosphor Bronze, plain castings	per lb.	11½d. to 1/2	11½d. to 1/2	..
p „ rolled bars & rods	per lb.	1/- to 1/3	1/- to 1/3	..
p „ „ strip & sheet	per lb.	From 1/2	From 1/2	..
c Platinum	per oz.	£4 1	£4 1	..
p Silicium Bronze Wire	per lb.	9d. to 1/-	9d. to 1/-	..
i Steel, Magnet, ace'd'ng to desc'p'n	per ton	From £15 to £40	From £15 to £40	..
i „ „ in bars		£58	£58	..
g Tin, block	per ton	£127 to £128	£127 to £128	..
g „ foil	per lb.	1/6	1/6	..
m „ wire, Nos. 1 to 16	per lb.	1/7	1/7	..
p White Anti-friction Metals — "White Ant" brand	per ton	£36 to £60	£36 to £60	..
j Yarns, 2/10s Grey Cotton, on sp'ls	per lb.	7d.	7d.	..
j „ 6 ips. Flax	per lb.	5¾d.	5¾d.	..
j „ 3 ply 12 lbs. Russian ..	per lb.	5½d.	4½d.	..
j „ 10 lbs. Russian, single ..	per lb.	4¾d.	4½d.	..
j „ 180 lbs. Jute rove	per ton	£11 10	£11 10	..
k Zinc, Sh'ts. (Vieille Montagne brd.)	per ton	£23	£23	..

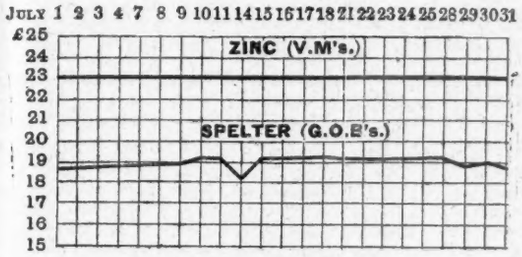
Quotations supplied by { a Messrs. G. Boor & Co. b The British Aluminium Co., Ltd. c Messrs. Thos. Bolton & Sons. d Messrs F. Wiggins & Sons. e Messrs Frederick Smith & Co.

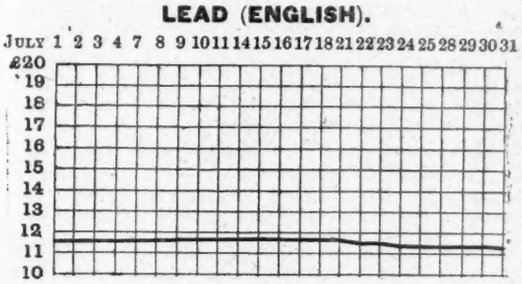
Quotations supplied by { f India-Rubber, G.-P. and Teleg. Works g Messrs. James & Shakspeare. [Co., Ltd. h Messrs. Edward Till & Co. i Messrs Bolling & Lowe. j Messrs Walter H. Hindley & Co., Ltd.

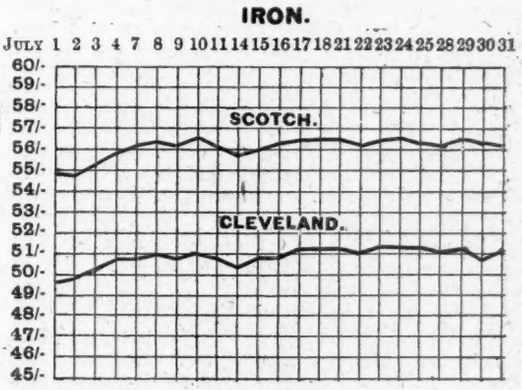
Quotations supplied by { k Messrs. Morris Ashby, Limited. m Messrs. W. T. Glover & Co., Ltd. n Messrs. P. Ormiston & Sons. o Messrs. Johnson, Matthey & Co., Ltd. p The Phosphor Bronze Company, Ltd.

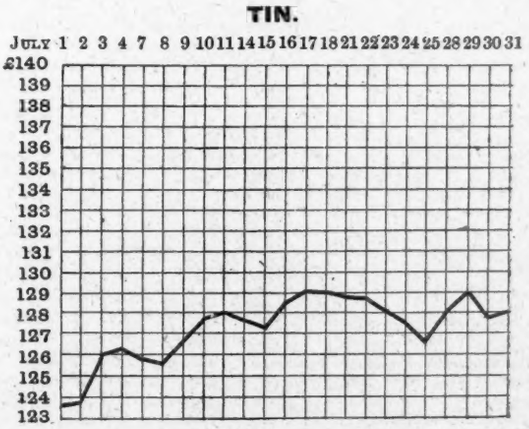
METAL MARKET.

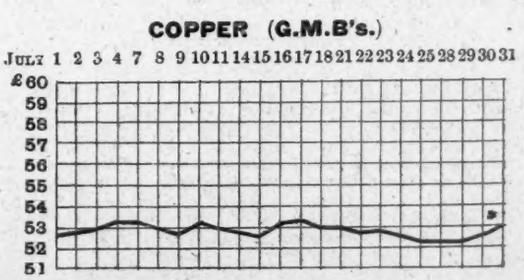
Fluctuations in July.











USE OF STORAGE BATTERIES IN ELECTRIC DISTRIBUTION SYSTEMS.*

By A. A. DION.

It has been the general practice in designing electric light and power stations and in selecting the equipment most suitable for the work to be performed, to consider every type of generating apparatus and auxiliary devices, except the storage battery. When it was introduced it was generally an afterthought, or a means of overcoming a difficulty which had developed in the operation of a plant. As the storage battery factor has in many cases a distinct bearing on the capacity of the generating plant, much outlay and expense would often have been saved by providing for the battery in the first place as an integral part of the installation.

The writer does not claim that it is advisable to use batteries in all kinds of electric plants, or in any kind of plant, under all conditions, but the motive of this paper is to enter a plea for the due consideration of the storage battery as a possible factor influencing the design of electrical installations, with a view to their efficient, economical and uninterrupted operation.

One of the most serious drawbacks in the operation of electric supply stations is the inability to store the product, so that generating machinery must be installed of capacity sufficient to meet the largest demand, even if such demand only lasts a few hours, and is only made once a year.

One of the things most sought in operation is close voltage regulation, regardless of the amount and character of the load. The storage battery provides the only known means of reducing the generating plant and ensuring its operation under best conditions for economy, by taking energy therefrom during the hours of light load and returning it to the circuit whenever the demand upon the station exceeds the capacity of the generators.

The storage battery ensures close regulation of voltage at the station, by keeping an even load on the generators and prime movers, whether engines or water-wheels, thus maintaining generator losses constant and preventing fluctuations of speed. The voltage may also be maintained constant at the point of distribution by placing a battery there.

The storage battery also ensures uninterrupted service, as it permits of shutting down one or more units, either to make repairs or for economy in operation.

These advantages, which may be obtained by the judicious use of storage batteries, must appeal to all; but one must closely observe the behaviour of batteries in practical operation to fully appreciate their value. Hence the writer would urge those who have not already done so, to visit and study some of the battery installations, of which many may be found in the United States, and a few in Canada, in operation under various conditions.

Storage batteries cannot be charged by alternating currents, therefore their use is confined to installations where direct current is available, but not necessarily only to plants generating or distributing direct currents exclusively. Thus, batteries may be used in connection with the following systems:—

1. Direct-current generation and distribution for light and power services.
2. Direct-current generation and distribution for railway service.
3. Alternating-current generation and transmission, and direct-current distribution for railway service.
4. Alternating-current generation and transmission, and direct-current distribution for light and power services.
5. Alternating-current generation and distribution for light and power services.

These services can, of course, be mixed. There are plants in which two or more systems are combined. Considering the application of batteries to each in turn, the mixing or combining of systems will not, of course, interfere with the usefulness of the batteries.

Direct-Current Generation and Distribution for Light and Power Services.—Upon a system of this kind a battery can be installed at the power house where the current is distributed by the two or three-wire method, or it can be located at a point out on the line near the centre of distribution. In many cases batteries are used for both purposes upon the same system.

Although the nature of the load may vary from day to day, the actual load falling upon the generator may be adjusted, so that it is practically the same each day, the battery taking the irregularities. This is of manifest importance from the standpoint, not only of efficiency, but of satisfactory and simple operation.

The result of the operation of a battery at a sub-station is not only to relieve the main station, but also to reduce the copper investment or copper loss, and the removal of the fluctuations of voltage, due to the varying drop in the conductors, caused by fluctuating loads.

Direct-Current Generation and Distribution for Railway Service.—It is evident that the same advantages which obtain from the use of batteries in general light and power service will apply here. The charge and discharge curve, however, will be very different, as the peaks of the railway load will occur every few seconds. The generators will be made to carry all day substantially an even load, much under the maximum demand, and the regulation will be wonderfully improved, especially if batteries are placed at one or more points on the line.

* Abstract of paper read before the Canadian Electrical Association at Quebec, on June 13th, 1992. Mr. Dion is superintendent of the Ottawa Electric Company, Ottawa, Ont.—*Western Electrician.*

Alternating Current Generation and Transmission and Direct Current Distribution for Railway (or Lighting) Service.—In such systems (whether combined with direct current lighting or not) the alternating current is usually received from a distance and distributed from rotary sub-stations. From the direct current end of the rotary the distribution is similar to the cases cited above. It therefore follows that batteries fulfil the same general requirements as before, and the battery may be installed in the rotary sub-station in parallel with the direct current end of the rotary, or it may be placed out upon the line. The advantages arising from such installations are the same as discussed above. In this case it has the additional advantage of reducing the number and size of the rotaries, and in an emergency reserve the battery has still greater advantages on account of the added risk of breakdown on the alternating current transmission lines. In most cases the energy is derived from water-power, and the battery not only takes care of the fluctuations in the load, but also of the variations in the alternating current power available.

Alternating-Current Generation and Distribution for Light and Power Services.—Since the storage battery is of necessity a direct current appliance, it is, of course, impossible to instal it directly in parallel with alternating-current machinery, and where the entire system, both of generation and distribution, is of this character, it is necessary to instal in connection with the battery a motor-generator or rotary, charging the battery and discharging it through the direct-current end. On charge the alternating-current end of the rotary will act as a motor, and on discharge it will act as a generator in parallel with the alternating-current system. The battery and rotary can be placed in the main station or at points out on the line near centres of distribution. The objection to this method is that the rotary must be of very large size, that is, it must carry the entire output of the battery, when it is discharging at its maximum rate.

The writer does not know of any place where such a system was ever installed for the above purpose, but rotaries with batteries in parallel, used for direct-current distribution, have been employed in certain emergencies to assist in carrying the alternating current load.

But we have not considered the case of stations which generate alternating currents only, or sub-stations receiving alternating currents only from a distance, which distribute alternating currents for light and power, but where it is found necessary to operate rotaries for railway service, elevator power service, or to supply direct-current motors installed under a direct-current generating plant, which has been displaced by alternating-current apparatus. In any of these three cases the fluctuations of direct-current load must not be allowed to impair the voltage regulation on, say, the alternating-current lighting feeders. The storage battery if placed in parallel with the direct-current end of the rotaries may be made to absorb the fluctuations of load, and enable the rotaries to run steadily under practically constant load, thus improving the regulation on both the direct-current and alternating-current systems of distribution. At certain seasons the peak of the alternating-current lighting load may come at a time when the direct-current load is light; in such a case the battery would be made to run the rotary as a direct-current motor, causing it to generate alternating currents in parallel with the alternating-current generators, and relieving these of part of the station load.

Some three years ago the writer installed a battery in Ottawa, in multiple with direct-current generators, operating at 250 and 500 volts, on a three-wire system. The battery was placed at the centre of distribution, about 1½ miles from the station. Owing to bad speed regulation of waterwheels and a varying load of direct-current motors, including many direct-connected elevators, it had been found impossible to obtain regulation which would be satisfactory to many of our customers. Complaints were both loud and deep for a time, until the battery was put in service. Although this battery was operated without booster or regulating device of any kind, the improvement in regulation was such as to silence all complaints, and to elicit complimentary remarks from many of our customers.

The rather high first cost of storage batteries makes the question of their profitable employment sometimes difficult to solve in their favour, but it is a matter of calculation, and not a difficult problem, if you know the cost of producing power, also the rate of depreciation on the batteries and cost of maintenance, which, together, should not exceed 10 per cent. per year.

LONDON UNIVERSITY NEW DEGREE AND FACULTY IN ENGINEERING.

Recognising the importance to engineers of the scheme of the London University for examinations in the newly created faculty of engineering, the Council of the Institution of Junior Engineers were fortunate enough to arrange for the members to have the processes for the acquisition of the degree explained to them by the secretary of the University's Board of Civil and Mechanical Engineering and Member of the Faculty of Engineering—Mr. Sidney H. Wells, Wh.Sc.

A large attendance of the members at the Battersea Polytechnic on Friday, July 29th, testified to the keen interest taken by them in the matter. Mr. Wells, who is principal of this Institution, previously to giving his address, invited the visitors over the newly-arranged engineering laboratories, workshops, &c., there. The machinery was kept running, and apparatus shown in action as used for experimental demonstration. In the electrical testing room and workshop were seen six units of different types of electrical plant for the use of the students, and it may be remarked that the lighting plant of the building is also available for instructional purposes. The new machinery has been specially designed so that all the operations to be performed in electric power stations, whether with continuous, alternating or polyphase currents, may be shown and tested under actual working conditions. Special attention is devoted to problems relating to electrical traction, and the character of the equipment generally indicates that the teaching requirements as demanded by modern practice have been well provided for.

The members having assembled in the engineering lecture theatre, Mr. Percival Marshall, the chairman of the Institution, took the chair, being supported by Prof. A. G. Greenhill, F.R.S., vice-president, and other gentlemen.

Mr. Wells first referred to the University of London under the old dispensation. Formerly an examining body only, it had now become also a teaching organisation, as the result of considerable agitation and strenuous efforts on the part of those anxious that London should possess the advantages enjoyed by Oxford, Cambridge and other Universities. Prof. W. Cawthorne Unwin, F.R.S., had throughout exercised himself most unsparingly towards the attainment of this result, and it was gratifying to mention that he had been appointed on the University Senate as representative of the Faculty of Engineering.

The revised regulations for matriculation—the first step to the degree—were explained, the most important of which, to the engineer, was that Latin would no longer be a compulsory subject. The engineering student passing, for instance, in the following five subjects would obtain his matriculation pass certificate:—(1) English. (2) Elementary mathematics (arithmetic, algebra to geometric progression, and Euclid to Book IV.). (3) Elementary mechanics. (4) Geometrical and mechanical drawing. (5) French or German. The first new matriculation examination was to commence on September 15th next; the forms of entry were to be obtained from the Principal of the University of London, South Kensington on or before the first day of that month, the fee being £2.

The second movement towards the degree was the intermediate examination, and here again the new regulations had been framed to include those subjects with which the engineer would be more or less conversant in his every-day work, viz.:—(1) Mathematics, not including the calculus. (2) Applied mathematics and experimental mechanics. (3) Electricity and magnetism, or heat, sound, and optics. (4) Engineering drawing and design. (5) Either heat, sound and optics, or electricity and magnetism, or chemistry or geology.

The papers of the final examination were divided into two groups:—Group "A" consisted of (1) Theory of machines and machine design. (2) Theory of structures and structural design. (3) Strength and elasticity of materials. (4) Electrical technology. Three of these subjects only were to be taken. Group "B," of which at least two subjects were to be taken, comprised (1) Hydraulics. (2) Surveying. (3) Theory of heat engines. (4) Design of electrical machinery and apparatus. (5) Generation, transmission, and distribution of electrical energy. (6) Mathematics. (7) Advanced theory of machines and structures.

Mr. Wells proceeded to explain that there would be two classes of students, known respectively as internal and external. The former would be not only those attending one of the affiliated schools of the University during the daytime, but also those studying in the evening under appointed teachers of the University, which arrangement it would at once be seen would be of immense advantage to those whose occupation at their ordinary vocations during the day would only permit of their studying at evening classes conducted by these recognised teachers at certain of the Polytechnics and Schools in Engineering of London. It should be noted that the class and laboratory work done by internal students would be taken into account in the examinations. The external student acted quite independently of the affiliated colleges or the recognised teachers.

One illustration of the utility to the engineer of the possession of the degree was afforded in the fact that the Institution of Civil Engineers accepted it in lieu of their examination in connection with election as an associate member. It would also, no doubt, be largely recognised by engineering employers in considering the qualifications of candidates for vacancies in their works.

On the motion of Prof. Greenhill, seconded by Mr. F. S. Pilling, a vote of thanks to Mr. Wells and his assistants was cordially adopted. In the course of his reply to various questions put by the members, Mr. Wells observed that the ordinary plan of study which would be recommended for an engineering student, and that necessary in preparing for the degree, were practically identical, so that the attainment of B.Sc. in Engineering was within the reach of every earnest aspirant for it.

Automatic Fire Alarms.—The British Fire Prevention Committee on Wednesday last week at their testing station, Bayswater, carried out various tests with automatic fire alarm systems. The arrangements for the test were made as "natural" as possible, and in each case the alarms gave the necessary notice after a few seconds of smouldering fire, whereupon a period of three minutes was allowed to elapse to mark the time required to obtain indoor assistance. The fire was thereupon extinguished by hand apparatus, the amount of water used and the damage done being minimal.

THE OLD AND THE NEW ELECTRICAL THEORY.

By ALEX. P. TROTTER.

Introductory Note.

In a lecture delivered before the Military Society at the Castle, Cape Town, in June, 1899, an attempt was made to present the leading features of the old and new electrical theory by stringing together extracts from various writers and by few experiments. But since that date the hypothesis of electrons has made a bold bid for recognition as a theory, and it might be contended that the title should be altered to "The Old and the Last Electrical Theory but One." A paragraph has been added near the end to give a superficial sketch of the electron hypothesis.

The Old and the New Theory.

Many of the recently observed facts of electrical science do not fit the old theory, and, like many other old theories, it must go and give place to another. Although the first glimpse of the new theory was seen by Faraday, "who constantly endeavoured to emancipate his mind from the influence of those suggestions which the words 'electric current' and 'electric fluid' are too apt to carry with them," * progress in this theory has been made only by a few mathematicians. "By current," wrote Faraday in January, 1893, "I mean anything progressive, whether it be a fluid of electricity, or two fluids moving in opposite directions, or merely vibrations; or, speaking more generally, progressive forces." †

Although Faraday had a dim vision of the new theory, though Maxwell planned the foundations, Lord Kelvin, Oliver Heaviside, Poynting, Oliver Lodge, Larmor and Fitzgerald have sketched elevations, and Hertz has actually built a substantial basement, the structure is far from finished, and a mazy scaffolding of mathematical work, far in advance of all the solid structure has been standing for some years with little alteration. Hidden away in the mathematical writings of a few men there are, to change the metaphor, like nuggets in quartz, many plain and easily-appreciated morsels of the new theory, and the object of these articles is not to give an original and popular account of the electrical theory, but merely to string together some of these nuggets for those for whom the mathematical ore is too hard to crush, or who have no time or inclination to extract from it the wealth of science which there lies hid. Hopelessly hidden from most people.

The old theory must go. But what do we mean by a theory? First let us see what we mean by science.

Science, Hypothesis and Theory.

The difference between knowledge and science lies, not in the quantity of facts, nor the accuracy with which they are known, nor their usefulness; but in their arrangement. A gardener may be able to name and successfully to cultivate hundreds of plants and flowers, a doctor may be able to diagnose many diseases and prescribe the right treatment and drugs, without any science. A large proportion of the so-called science teaching of the present day is merely the imparting of a number of interesting facts. The grouping of facts into systems, and the recognition of the relations between them is science. The aim of science is to arrive at what are called laws. A scientific law is a brief statement of the relationship between a group of facts. These laws only tell us *how* the facts occur, not *why* they occur. A theory is a longer statement, and often includes several laws. A theory in an early imperfect stage is called an hypothesis. A large number of hypotheses may be made on a single fact by the ingenious. Neither the preliminary hypothesis nor the complete theory really explains the facts, but a theory is sound and complete in so far as it is a satisfactory description of all the facts in a group, and not only those which we know to-day, but those which may be observed to-morrow or 20 years hence will have to be included in that group.

An eminent physiologist is of opinion that one cannot start on a scientific research, nor even on a train of thought, without an hypothesis. "How many facts does it take to make an hypothesis?" asked the five-year-old son of this man. This is no childish question. How many facts, it might be asked, does it take to make knowledge? and to reply to another pair of questions, How many people does it take to make a crowd, and how many to make a corps? To the first no definite answer can be given—say two or three dozen; but two, or, at all events, three men marching in step, in line, or file, and evincing discipline, order, and system, constitute a squad; and a regiment, or, indeed, an army, differs only in quantity, not in quality.* So two or three facts, systematically classified, with a recognition of their relationship, pass from knowledge to science, and that they are so classified, and that their relationship is recognised, implies that there is an hypothesis. But in a course of lectures on electrical, chemical, astronomical, or optical matters, brilliant with popular descriptions, full of useful information, illustrated with elaborate experiments, coupled, perhaps, with the study of text-books, and culminating in an "honours" examination and degrees, there may not be a scrap of science.

According to an ancient astronomical hypothesis, a new moon was created every month, and grew by eating the stars, and afterwards died. Somewhat later it was held that the sun, the same sun every day, passed west, and re-appeared in the east from below a flat earth. In A.D. 140, Ptolemy taught that the sun and moon moved in circles, whose centres described circles round the earth. This was not so much an erroneous explanation as an insufficient attempt to describe in brief language a too limited range of phenomena. Then, Copernicus, at the end of the middle ages, made an immense advance in brevity and accuracy of description, but more facts remained to be included. Kepler's ellipses followed, and finally Newton's law of gravitation, which, in a single formula, covers not only the motion of the planets, but that of their moons, and of bodies at their surfaces. The law of gravitation is not so much a discovery by Newton of a rule guiding the motion of planets, as his invention of a method of briefly describing the succession of events which we call planetary motion. It describes *how* every particle of matter in the universe is altering its motion with reference to every other particle. It does not tell us *why* the particles thus move; it does not tell us *why* the earth describes a certain curve round the sun; it simply economises thought by resuming in a few words the relationship observed between a large range of phenomena. Such laws simply describe—they never explain.† And it should be observed that the law of gravitation is sufficient, and, so far as it goes, complete, although it does not give the slightest hint what gravitation is.

"From a group of experimental facts we may divine a certain relation, and by generalising it from the particular cases observed, make it a law, empirical so far, *i.e.*, not deducible from previously known laws at the time, though it may become so later. Such a law is that of gravity; though so long since its discovery it has not been satisfactorily explained by more easily understood laws. Ohm's law is also without explanation, whilst, on the other hand, the gaseous laws have been explained dynamically, as Newton's law of gravity and Ohm's law may be some day."‡

The corpuscular theory of light was very useful in its day. All the more important facts of optics which had then been observed fitted it, it was possible to make accurate calculations and predictions with it, just as the older astronomers accurately predicted eclipses and the movements of planets. But new facts were observed which could only be reconciled with the theory at the expense of great ingenuity and stretch of imagination. Then a totally different hypothesis was started, and this was found to fit not only all the facts which had been observed, but indicated others which were observed as soon as they were looked for. This is one of the most sure tests of the soundness of a hypothesis; indeed, when it has achieved this much, it may take rank as a theory.

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* Clerk Maxwell, "Electricity and Magnetism," Vol. ii., p. 195.
† "Experimental Researches," Michael Faraday, Vol. i., p. 81, sec. 283.

* Note, this was written before the war.
† Karl Pearson. "The Grammar of Science," p. 119. 1st edition
‡ Heaviside, Vol. i, p. 278.

If we are to avoid the risk of wasting work on a wrong hypothesis, it is well to begin as far back as possible, and not to jump into the middle of a collection of facts, and try to deal with all that happen to be within reach. "There are," writes Oliver Heaviside, "poetical explanations of natural phenomena, as might be expected, these are very bad. The illustrious Goethe's explanation of colour should be a caution to poets to the end of time to keep to their poetry. He borrowed a prism, stuck it to his eye, and looked through it. He did not see Newton's spectrum, but something quite different, and he hastily concluded that Newton's theory was all quite wrong, and set to work to write a book in which the whole thing was properly explained, and Newton's theory demolished."*

Concepts and Percepts.

If we go very far back, we approach the outskirts of physical science, and beyond lies the difficult region of metaphysics. A very little of this science is enough for most students of physics, but that little is very useful. Enough, and perhaps more than enough, for them is to be found in Karl Pearson's valuable Grammar of Science, from which several quotations, not always following the exact words of the writer, are made in the present articles. A very valuable feature of Karl Pearson's work is the distinction which he makes in popular language between a concept and a percept.

A square table and a round table are percepts. We perceive them with our senses of sight and touch, they are phenomena, because from the metaphysical point of view we know nothing of them beyond our perceptions of them. A further and a very irritating idea with which metaphysicians annoy students of physics is that they tell us that these two tables exist only so far as we perceive them, and that they are "only phenomena," and this statement is sometimes made in language which almost implies that if we cease to perceive them and to think about them, they no longer exist. Be that as it may (for it certainly is not physics) it is sufficient for the present purpose to observe that these two tables differ from each other, mainly because one is square and the other is circular. The tables are perceptions, but squareness and circularity are conceptions. Whether a table is a "thing-in-itself" or no is of small importance compared with the assurance that circularity and squareness are *not* things. But the word concept or conception is used in two senses; circularity and squareness are abstractions. We may draw a very accurate circle on paper. What we perceive is a thin black line, and the *form* of this line, unless we detect irregularities in it by examining it through a microscope, exhibits our idea of circularity.

In another sense, the corpuscles of the corpuscular theory of light were concepts, for they were conceived and certainly never perceived. In other words, they were imagined, and, to use a common phrase, they existed only in the imagination. In this sense the ether which we conceive to be the medium in which light is propagated is a concept; it has never been perceived, but the modern theory demands that we should conceive it. Similarly, atoms and molecules are necessary concepts. Light, heat, energy and gravitation, again, are concepts of a different kind; for they are not "things" like tables, nor imaginary bodies like light corpuscles or atoms, nor mere abstractions like squareness or circularity. The important question upon which the old electrical theory must stand or fall, is, Are electricity and electric currents necessary concepts? In the modern theory they are not necessary; and both, especially the former, are very misleading, and it is a matter of great regret that the word current must remain, for it is too late now to change it. The word electricity, on the other hand, can be thrown overboard at once, it is worse than useless; the adjective electrical may remain, for it is useful to describe a category of phenomena, as do the adjectives geological and botanical. These words electricity and current are relics of a crude mechanical theory, which, like the corpuscular theory of light, was useful enough in its day. The very word current implies that something flows, and this thing, of course, was electricity. It fits the facts fairly well so long as we work with batteries, wires and electro-magnets as in ordinary telegraphy, or with dynamos and electric light or motors. For such purposes the old theory is good enough, with here and there a formula which must be accepted as an article of faith. But when we begin to study the recent developments of electrical science, the old theory is not sufficient. We might, it is true, tack something on to the old theory, and leave the rest to go on, because it has been so useful in the past, but that is bad science. The amazing intricacies of the Ptolemaic system of astronomy are an example of the result of adding bits to old theories. There was a time when the difficulties into which the old theory of electricity has led us, might have been avoided, but German philosophers, "Weber and Clausius, seemed determined," writes Heaviside, "to make an electric current be static electricity in motion round a circuit, and they have made elaborate attempts, with much success, to find the law of force between two charges of electricity in motion, to include electrodynamics as well as electrostatics."*

"We can form no conception of an electric current," wrote Clerk Maxwell, "except as a kinetic phenomenon—that is to say, its energy is the energy which a moving body has in virtue of motion. The electricity in the wire cannot be considered as the moving body in which we are to find this energy, for the energy of a moving body does not depend on anything external to itself, whereas the presence of other bodies near the current alters its energy. . . . . We are, therefore, led to inquire whether there may not be some motion going on in the space outside the wire, which is not occupied by the electric current, but in which the electromagnetic effects of current are manifested.†

"There are other questions which have existed," writes Prof. G. F. FitzGerald, "but which have been experimentally decided. The most celebrated of these are the questions between the caloric and the kinetic theories of heat, and between the emission and undulatory theories of light. The classical experiments by which the case has been decided in favour of the kinetic theory of heat and the undulatory theory of light are some of the most important experiments that have ever been performed. When it was shown that heat disappeared whenever work appeared, and *vice versâ*, and so the caloric hypothesis was disproved; when it was shown that light was propagated more slowly in a dense medium than in a rare, the sciences of light and heat were revolutionised. Not but that most who had studied the subject had given their adhesion to the true theory before it was finally decided in general estimation. In fact, Rumford and Davy's experiments on heat, and Young and Fresnel's experiments on light had really decided these questions long before the erroneous views were finally abandoned. I hope that science will not be so slow in accepting the results of experiment in respect of electro-magnetism as it was in the case of light and heat, and that no Carnot will throw back science by giving plausible explanations on a wrong hypothesis. . . . Elementary text-books that halted between two opinions, and, after the manner of text-books, lent towards that enunciated in preceding text-books, had all perforce to give prominence to the true theory, and the whole rising generation began their researches from a firm and true standpoint. I anticipated the same results to follow Hertz's experimental demonstration of a medium by which electro-magnetic actions are produced. Text-books which have been gradually invoking lines of force, in some respects to the aid of learners, and in others to their bewilderment, will now fearlessly discourse of stresses in the ether that cause electric and magnetic force. The younger generation will clearly see in electro-magnetic phenomena the working of the all-pervading ether, and this will give them a true and firm standpoint for further advances."‡ But the old theory had taken deeper root than Prof. FitzGerald thought when he uttered these words nearly 14 years ago. Most science teachers are aware of the new theory. Some understand it, but nearly all treat it as too strong meat for their babes, who are still nurtured, if not on the electric fluid itself, at least on "currents of electricity." They would rather meet the question, "What is electricity?" with a smile, and put it by, than face inquiries about the stresses in the ether. "We

* Oliver Heaviside. Electrical Papers, Vol. i, p. 335.

* Oliver Heaviside, "Electrical Papers," I., 296.

† Clerk Maxwell, "Electricity and Magnetism," II., 182.

‡ British Association, 1888, Prof. G. F. FitzGerald's address to Section A.

do not know," continues Prof. FitzGerald, "what the structure of the ether is by which it can pull, but neither do we know what the structure of a piece of india-rubber is by means of which it can pull, and we might as well ignore the india-rubber, though we know a lot about the laws of its action, because we do not know its structure, as to ignore the ether because we do not know *its* structure."

"Most electricians are accustomed to confine their attention to only one part of the wonderful phenomena occurring during the existence of a conduction current . . . . it is the current in the wire that is the first object of attention, and what goes on outside is ignored. We are aware of the existence of an external magnetic field, and also of an electric field . . . . but, as the steady conduction current is independent of them, they are ignored." *

(To be continued.)

AN AMERICAN ECHO.

For 12 months or more we have been subjected to a torrent of papers, articles, and speeches on the possibility or impossibility of running our railways electrically, and there comes now through the medium of the *Western Electrician* an abstract of a paper read at the annual convention of the American Institution of Electrical Engineers, by Dion J. Arnold, dealing exhaustively with the question from one point of view.

All the deductions and estimates were based on tests carried out in great detail with a well-equipped dynamometer car, which is owned jointly by the Illinois Central Railway Company and the *University of Illinois*. We venture to believe that the possession of such a practical piece of apparatus has not been considered in any British technical school, and it proves once more how admirably our cousins equip their sons with the means of competing with the world in the profession of engineering.

The tests were made over about 5¼ miles of four-track road between Mott Haven Junction and Grand Central Station, N.Y., over which trains from the three divisions of the New York Central and the main line of the New York, New Haven, and Hartford Railroads enter New York. Two miles of this track are in tunnel, and it was the annoyance to passengers caused by steam locomotives in this tunnel that induced the company to consider the use of electrically-drawn trains.

The conditions were such that motor coaches were ruled out of court, single locomotives alone being considered. The abstract gives a good description of the dynamometer car, the conditions of the tests and the methods of arriving at the essential figures; but we propose only to state briefly the gist of the judgment arrived at on these figures.

The writer of the paper is in agreement with the majority of English engineers that the alternating-current motor will prove yet to be the most efficient for long-distance work, but that it has not yet demonstrated its ability to start under load as efficiently, or to accelerate a train as quickly, as the direct current motor; and it was quite useless to think of it on the line in question, where the trains were running under very short headway on a short stretch—frequent stops and rapid acceleration after each, in order to bring up the mean speed, being the chief characteristics. Therefore it was advised, if conversion was found worth while, to adopt the direct current system with a third rail for the main line and overhead trolley for the yards.

Table I.—Table of Estimates on Plans for Proposed Electrical Equipment of the N. Y. C. & H. R. R. R. Between Grand Central Station and Mott Haven Junction.

Plan.	Character of stations, &c.	Cost of operation at switch-board.	Cost of operation at contact shoe.	Cost at motor terminals.	Operating expenses per loco.-mile.	Fixed charges per loco.-mile.	Total cost per loco.-mile.
1	Direct-current power station at centre of line and contiguous to tracks. 600-volt working conductor, no batteries	·447c.	·60c.	1·06c.	14·02c.	6·58c.	20·60c.
2	Same as No. 1, with batteries in power house	·472	·66	1·137	14·65	6·71	21·36
3	Same as No. 1, with battery sub-station near Grand Central Station and Mott Haven Junction	·475	·668	1·20	14·7	7·25	21·95
4	Alternating-current power station on river front near centre of line, with rotary-converter sub-stations near each end of line. 11,000-volt A.C, and 600-volt D.C.	·572	·715	1·287	15·2	7·58	22·78
5	Combined D.C. and A.C. power station at Harlem River near one end of line and one rotary-converter sub-station near the other end of line. 11,000-volt A.C, 600-volt D.C., no batteries	·570	·666	1·19	14·7	7·18	21·88
6	Direct-current feeders from Manhattan Railway sub-station located near centre of line. Transmission from sub station to working conductor, 600-volt D.C. energy to be purchased	2·5	2·650	2·748	34·64	2·89	37·53
7	Rotary-converter sub-station at centre of line. A.C. energy to be purchased from Manhattan sub-station and transmitted at 11,000 volts. Energy to cost ½ cent less per KW.-hour than D.C. energy delivered	2·5	2·336	2·508	31·50	4·23	35·73
8	Two rotary-converter sub-stations, one near each end of line. A.C. current to be purchased from Manhattan sub-station near centre of line ...	2·1	2·336	2·504	31·50	3·93	35·43
9	Combined A.C. and D.C. power station near Harlem River at end of line. One sub-station near other end, and batteries carried on locomotives charged from working conductor	·519	·629	1·122	16·58	7·7	24·34
10	One rotary-converter sub-station near centre of line, A.C. current purchased from Manhattan sub-station No. 7, batteries on locomotives charged from working conductor...	2·12	2·4	2·502	34·40	4·08	38·48
11	Direct-current feeders from Manhattan sub station No. 7, near centre of line. Batteries on locomotives charged from working conductors	2·5	2·738	2·742	37·81	2·51	40·32
12	Combined A.C. and D.C. power station at Harlem River near outer end of line. One sub-station near other end. Batteries in power station and sub-station. A.C. transmission 11,000 volts, D.C. conductors 600 volts	·55	·7751	·335	15·80	7·83	23·63

The actual generation of power was considered very thoroughly, and 12 schemes were put forward for comparison.

The estimated costs of each of these schemes are tabulated above, and will repay study.

The costs are given in cents per unit. The total annual input at the contact shoes was estimated from load curves at 15,768,000 KW.-hours. The load diagram given is not unlike a lighting load curve, although it has two peaks of about the same altitude. These occur between 8 and 10 a.m. and 5 and 7 p.m., and probably coincide with the business rush. The average load factor would appear to be between 20 per cent. and 30 per cent.

The first column of costs represents the cost of generation at the power house, including coal, water, oil, waste, &c., and repairs and wages.

* Oliver Heaviside, Electrical Papers I, p. 494.

The second includes the above, and oil, waste, repairs, and wages in sub-stations, and repairs on transmission lines.

The third includes all expenses in the second column with the addition of 4 per cent. on total capital outlay, excluding cost of locomotives, and taxes at 2 per cent. on buildings, land, and machinery. The fourth and following columns require no explanation.

It strikes us as a weak point that no depreciation charges enter into the fixed charges, as these would not, we fear, cancel out in the comparison between steam and electricity.

Although No 1. scheme pans out most favourable on paper, it was not considered seriously, as it necessitated placing the power station in the centre of the city, and the authorities would have had something to say about that. The same objection throws out schemes 2 and 3. The difference in the total costs of Nos. 4 and 5 is the difference between one and two sub-stations.

The next two schemes proved quite conclusively that it would not pay to buy energy, and Nos. 10 and 11, which are in the same case, are interesting only because it was proposed to place batteries on the locomotives. This was mooted in order to eliminate the troubles anticipated with overhead construction in the terminal stations and shunting yards, which look, on the drawing given in the reprint, something like a diagram of the muscles, or nerve centres in a human body. The third rail would be used on the main line, and these complicated places would be negotiated with the batteries, these being charged while running on the third rail.

No. 9 scheme comes out near the top, if the first three schemes are not considered for the reasons given above; but No. 12 was recommended, although the total cost of operation under this scheme is slightly greater than No. 5. It was believed, however, that the addition of the batteries in the power and sub-station, while increasing the cost of operation, would give the most valuable advantage of an insurance against the shutting down of the lines, due to some mishap at the power station, besides regulating the pressure, and reducing the cost of generation, by maintaining a constant load on the engines.

With this verdict we have no fault to find, although we think it should be possible nowadays—in fact, we know it is possible—to construct a power station of any size in the heart of a city without causing a nuisance either with smoke, steam, or vibration. If this could have been done, and No. 3 scheme adopted, all the advantages of No. 12 would have been gained, and the total cost of operation per loco.-mile reduced by over 1½ cents. In that event, perhaps the conclusion of the paper would not have been so disappointing from the point of view of the electrical engineer. This conclusion is based on the following figures:—

	Steam.	Electricity.
Operating expenses per locomotive-mile exclusive of fixed charges, but including water, labour, cost of cleaning and repairing tunnel, and all other expenses of locomotive operation	23·05	15·80
Fixed charges per locomotive-mile, assuming that it now requires 40 locomotives to perform the present service and that 33 electric locomotives could perform the same service	1·13	7·83
Total in cents	24·18	23·63

And it is "that while there would be a slight annual saving in operating expenses in favour of electricity, it is not sufficent to warrant its adoption on the grounds of economy in operation alone, although its adoption can be justified on other grounds." One had hoped for the difference to have been marked much more strongly. The last paragraph of the paper is quite hopeful:—"It is, however, safe to conclude that the saving in operation expenses by the electric system would be sufficient to offset the increased fixed charges due to the additional investment made necessary by its adoption."

Unfortunately, the case investigated is a special one in all its characteristics, and the results obtained cannot be applied to anything in the shape of main line work. There are, however, similar cases in England, and it is to be hoped that the companies affected are cognisant of all progressive researches such as we have outlined above.

THE ELECTRICAL INDUSTRY AND TECHNICAL EDUCATION.

By RANKIN KENNEDY.

The evidence recently given on this question, mostly by scholastic authorities before a Committee of the London County Council, testifies principally in favour of better educational facilities for the training of leaders in scientific industries. One leader of technical industry, Mr. A. Siemens, gives an opinion which is, perhaps, more valuable than opinions expressed by anyone not actually engaged in the industrial production of scientific machinery. First, he says manufacturers are fully alive to the value of highly trained educated men, and encourage such training and education. Now this may be true; no doubt most, if not all, manufacturers see the advantage of education, and encourage it, but that alone is an attitude without any effect for good. The question is, Do the manufacturers employ the most highly qualified leaders? Some few firms in this country do employ highly trained and qualified men, but no one who knows the industry, as carried on in Britain, can affirm that there is any demand for highly trained leaders by manufacturing firms. There are plenty of men to be had at this moment as highly trained and educated as men can ever be for leading work, and there never has been any scarcity during the past 10 years. On the other hand, during that time, Continental and American firms were employing all the talent, skill, and educational training at hand, and paying well for these advantages, in addition to spending large sums of money in working out and developing the industry under capable leaders. At the same time there was no demand in Britain for any such trained men, no money spent in preparing for the coming business, the leaders being reduced to the smallest possible number at the smallest possible salaries. The employers have been content to jog along making old bipolar dynamos, and taking orders as they happened to turn up for what they were pleased to call their "well-known specialities."

By dint of hard work, expenditure of money, and securing all the skill within reach, the foreigners eliminated faults in design, introduced new designs, standardised their manufactures, and equipped their factories with up-to-date machinery for the coming competition; we know the result. While we are crying out about backwardness the foreigner is equipping and successfully running large factories in our own homeland.

Is it reasonable to suppose that the education of leading engineers had anything to do with such a state of affairs? I trow not! As Mr. Siemens puts it, "Mental and commercial training are quite as necessary as technical training." If there had been manufacturers with requisite "mental and commercial training," they would have found no lack of men in Britain with the scientific ability to second them.

To throw the blame for our backwardness on lack of educational facilities, or on lack of men to take advantage of these facilities, is, in my opinion, utterly at variance with the actual facts.

The educated, highly-trained men in this country are mostly engaged in branches of electrical engineering where they cannot influence the manufacturers or their manufactures; in the past, some have attempted to assert themselves by manufacturing on their own account, others by starting as consulting engineers, teachers or professors, station attendants, municipal engineers, &c.

Manufacturers who are not progressive (perhaps aggressive is the better word), do not require highly-trained leaders, simply because these manufacturers will not be led out of the groove they have run in for so long.

The summary of the London County Council's Committee is worthy of more criticism:—

1. The lack of the aforesaid "mental and commercial training" of manufacturers is quite apparent to everybody; to this we must agree.

2. Defective technical or secondary schools:—In my opinion there are plenty of funds and schools, but the curriculum and the general arrangements of classes are, as a rule, not arranged for the best practical results; nor is the

teaching of the kind suitable for preparing for a scientific industry.

3. Lack of trained men :—This does not exist, for, if there were any demand which could not be supplied from home-bred materials, we could get foreigners by paying for them, as the foreigner does.

4. Lack of institutions for advanced work :—This may be, but the state of the industry could not be improved by additional high-class technical laboratories ; such places do not turn out leaders of industry, however useful they may be for research and standardising work. Men of character such as those who become live leaders of industry, do not come from a class who can be set to work in the usual type of advanced laboratory work. The leader can be educated, but he will be a leader all the same, even if not so highly educated as many others who could easily distance him in an educational competition.

The true history of the British electrical industry during the past decade is plain. When municipal installations began to be put down, our manufacturers were, from 1888 till 1895, fairly well in the running and full up with orders for plant which required little or no special scientific skill in its production, and the foreigner was not a competitor with anything better or cheaper. He was, however, if not competing for orders, making most effective preparations for doing so by adopting every improvement under the skilful guidance of the best ability to be found. Then, when prepared, he easily secures all our orders for electric traction, nearly all our large installations, and many smaller plants, leaving the home manufacturer plenty of time to cry out against competition, and to set to work to recover the lost ground, if he can.

This tendency of manufacturers to build up a business to a certain extent, making progress for a few years, and then resting upon the level attained, is a relic of the past; modern manufacturers must keep on progressing or be beaten in competition, and this constant progress can only be carried on with the aid of trained ability in the science and art of the industry carried on, and my contention is that there is plenty of that trained ability in Britain and elsewhere, but no demand for its employment in British industry —*vide* advertising columns.

We have everything necessary in Britain to carry on any scientific industry successfully, and the most convincing proof of this assertion is the very striking one that, during this period of stagnation in British works, at least three very large foreign works have been built and equipped here, despite the alleged lack of educational and technical laboratories. These firms, at least, think Britain is a favourable country for good paying scientific business, and their success confirms it.

It is to the lack of enterprise, and the neglect of scientific aid, failure to recognise the importance of improvements, by the commercial and financial leaders (without whom the scientific leader is powerless), that these industries owe their present position. This may be to some extent explained by the Limited Liability Company system of managing money matters, and want of *personnel* in management ; at any rate, there is an amount of inertia in the business at its very centre. Commercial progress must lead the scientific industries.

NEW PATENTS AND ABSTRACTS OF PUBLISHED SPECIFICATIONS.

NEW PATENTS, 1902.

Compiled expressly for this journal by W. P. Thompson & Co., Electrical Patent Agents, 322, High Holborn, London, W.C., and at Liverpool, to whom all inquiries should be addressed.

5,618A. "Improvements in and connected with interrupters for induction coils." J. Cervera (Baviera). July 16th. (Date claimed under Patents Rule 19, March 6th, 1902.) (Complete.)

5,618B. "Improvements in electric switches specially applicable for use in connection with wireless telegraphy." J. Cervera (Baviera). July 16th. (Date claimed under Patents Rule 19, March 6th, 1902.) (Complete.)

15,618. "Improvements in or connected with splicing ears used on trolley wires of electric tramway." J. Ramsey. July 14th.

15,674. "Improvements in electric motors." A. B. Holson. July 14th. (Date applied for under Patents Act, 1901, July 15th, 1901, being date of application in United States.) (Complete.)

15,677. "A bond for making an electrical connection between the hub and the felloe and tyre of railway and the like wheels having a wooden or other non-conducting body portion." A. H. Johnson. July 14th.

15,696. "Improvements in electric furnaces." J. Bouneau. July 14th.

15,714. "Improvements in and connected with electrical fuse boxes or cut-outs." C. D. Burnet. July 15th.

15,715. "Improvements in or connected with electric cable junction, terminal, and like boxes." C. D. Burnet. July 15th.

15,716. "Improvements in or connected with electric cable or conductor junction and like boxes." C. D. Burnet. July 15th.

15,735. "Improvements in the mode and means for electro-plating.' J. Bailey. July 15th.

15,747. "Improvements in or relating to electric storage batteries." M Sutherland and E Marcuson. July 15th.

15,753. "Improvements in electricity meters." The British Thomson Houston Company, Limited, and F. Holden.

15,764. "Improvements in the control of electric lifts." J. S. Stevens, C. G. Major, E. C. Stevens and P. H. Stevens. July 15th.

15,772. "Improvements in electric batteries." A. L. Shepard. July 15th.

15,784. "Improvements in and relating to thermo-electric couples and generators." C. B. Thwing. July 15th. (Complete.)

15,795. "Improvements in means for transmitting electricity to vehicles on electric railways." A. Beer. July 15th.

15,807. "Improvements in or relating to electric accumulators." C. de Sedneff. July 15th.

15,814. "Improvements in or relating to dynamos and electro-motors." R. F. Hall. July 16th.

15,815. "Improvements in or relating to electric fuse boxes for street mains and analogous uses." The Electric and Ordnance Accessories Company, Limited, and R. F. Hall. July 16th.

15,823. "Improvements in or connected with electrical fuse boxes or cut-outs." G. H. Nisbett. July 16th.

15,824. "Improvements in electric railway rail bonds." G. H. Nisbett July 16th.

15,825. "Improvements in electric railway rail bonds." G. H. Nisbett. July 16th.

15,882. "Improvement in automatic prepayment electric calling apparatus for use with telephones and other instruments." H. L. P. Boot and H. J. Dawes. July 16th.

15,842. "Improvements in electric switches applicable for electrically-driven hoists or other machines" J. C. Etchells. July 16th.

15,926. "An improved form of detachable link chain for electric fittings." T. McIntyre. July 17th.

15,935. "Sadler's electric tramcar life-saving guard." J. H. Sadler. July 17th.

15,944. "Improvements in electrical brushes for dynamo electrical machines, electrical motors and other electrical machines and apparatus where brushes for collecting an electrical current are or may be employed." The Tangye Tool and Electric Company, Ltd., and A. H. Bate. July 17th.

15,952. "Improvements in systems of electric motor control." W. S. Andrews. (Date applied for under Patents Act, 1901, being date of application in United States.) July 17th. (Complete.)

15,953. "Improvements in controllers for electric motors." R. H. Read. (Date applied for under Patents Act, 1901, July 26th, 1901, being date of application in United States.) July 17th. (Complete.)

15,954. "Improvements in electric switches." C. D. Haskins. July 17th. (Date applied for under Patents Act, 1901, July 27th, 1901, being date of application in United States.) (Complete.)

15,955. "Improvements in electrically operated switches or circuit breakers.' E. M. Hewlett and T. E. Button. July 17th. (Date applied for under Patents Act, 1901, January 7th, 1902, being date of application in United States.) (Complete.)

15,956. "Improvements in electric indicating instruments." R. Fleming. July 17th. (Date applied for under Patents Act, 1901, November 21st, 1901, being date of application in United States.) (Complete.)

15,963. "Improvements in and relating to the manufacture of lead plates for secondary electric batteries." C. Vellino. July 17th.

15,977. "Improvements in electric lifts." J. Bush and M. T. Medway. July 17th.

15,981. "Improvements in mechanical rail scrapers for grooved and other rails used on electric railways." E. M. Munro and H. I. Rogers. July 18th.

16,015. "Improvements in and relating to electrolysing apparatus." E. L. Thorp. July 18th.

16,062. "Improvements in electric railways." H. H. Lake. July 18th. (General Electric Company, United States.)

16,063. "Improvements in and relating to third rail contact shoes for electric railways." H. H. Lake. (General Electric Company, United States.) July 18th.

16,064. "Improvements relating to electric railways." H. H. Lake. (General Electric Company, United States.) July 18th.

16,093. "A life guard for electric tram cars." E. Hughes and M. Read. July 19th.

16,117. "Improvements in attaching pole-pieces or shoes to the castings of dynamo-electric machines or electric motors." R. B. Ransford. (Deutsche Elektrizitätswerke zu Aachen (Garbe Lahmeyer & Co.) Aktien Gesellschaft, Germany.) July 19th. (Complete.)

16,121. "An improved method and apparatus for telegraphing and telephoning on non-isolated submarine lines." B. Tychonski and K. Dollinger. July 19th.

16,130. "Improvements relating to electric furnaces." A. Sim. July 19th.

16,142. "Apparatus for indicating that an electric current has reached a predetermined amount, and for the consequent closing of a switch or switches.' J. Edmundson, W. A. Purdon, J. W. Dawson and Edmundson & Purdon Limited. July 21st.

16,160. "Improvements in electric lampholders." T. Chalmers. July 21s

16,165. "Improvements in electrical fire extinguishing apparatus." W. N. Stewart. July 21st.

16,191. "Improvements in electric train signals." W. J. Hare and J. P. Hare. July 21st.

16,205. "Improvements in dynamo-electric machines." A. Heyland. July 21st.

16,232. "Improvements in regulating devices for electric arc lamps." A. N Thorin. July 21st. (Complete.)

16,264. "Improvements in electrical switches and cut-outs." C. M. Dorman, R. A. Smith and H. G. Baggs July 22nd. (Complete.)

16,270. "A new or improved electric facia sign." A. Goldsmith. July 22nd.

16,293. "Improvements in or relating to electric switches." H. H. Lake. (General Electric Company, United States.) July 22nd. (Complete.)

16,294. "Improvements in and relating to electro-magnetic switches.' H. H. Lake. (General Electric Company, United States.) July 22nd. (Complete.)

16,319. "An improved device for adjusting the length of and taking up the slack in electric lamp cords and the like." G. C. Marks. (The Crescent Novelty Company, United States.) July 22nd. (Complete.)

16,325. "Improvements in dynamos." J. Davidson. July 22nd.

16,332. "Improvements in collectors for electric railways and tramways on the overhead conductor system." J. G. W. Aldridge. July 23nd.

16,341. "Improvements in and relating to the prevention of formation of deleterious vapours by electric discharges in air." H. Viertel and Siemens Bros. & Co. July 22nd

16,334. "Improvements in electric accumulators." H. Danner. July 29rd.

16,488. "A quick-break and a quick-make snap-off improved tumbler switch." A. Vandam and T. H. Marsh. July 24th.

16,495. "An automatic electric chain welding machine." J. E. Bousfield. ("Union" Actiengesellschaft, Switzerland.) July 24th. (Complete.)

16,521. "Electric lift controller." P. Dewhirst. July 25th.

16,541. "Cab telegraph and window catch." H. F. Keen. July 25th.

16,556. "Improvements in electric furnaces and in the production of chemicals in such furnaces." G. Brewer. (E. R. Taylor, United States.) July 25th. (Complete.)

16,564. "Improvements in electrically-controlled air brakes." C. D. Abel. (Siemens & Halske, Aktien Gesellschaft, Germany.) July 25th.

16,610. "Improvements in electrical switches of the 'tumbler' type." R. Hadley and F. J. Taylor. July 26th.

16,675. "Improved construction of apparatus for measuring electrical resistance." J. W. Record, H. Brooker and W. H. Goss. July 25th.

ABSTRACTS OF PUBLISHED SPECIFICATIONS.

Copies of any of these Specifications may be obtained of Messrs. W. P. Thompson and Co., 322, High Holborn, W.C., and at Liverpool, price, post free, 9d. (in stamps).

1900.

11,406. "Improvements in the electric equipment of railway vehicles for the purpose of lighting, heating, and ventilation." A. Zehden. Dated June 23rd, 1900. Relates to arrangements for electrically lighting, heating, and ventilating railway and tramway vehicles, each vehicle being provided with a dynamo, driven from an axle, and storage battery. 3 claims.

11,429. "An improved electromagnet of high attractive force." M. Vogelsang. Dated June 23rd, 1900. An electromagnet for use in lifting apparatus, &c., is combined with an automatic switch in such a manner that a strong current is first sent through the magnet coil so as to start the movement of the armature, and afterwards a weaker current. The armature or core situated within the coil is provided with an extension, which, when the armature is attracted, moves the switch lever in opposition to a spring and causes a resistance to be inserted. The resistance may be inserted either in series or in parallel with the coil. 2 claims.

11,438. "Improvements in casings for the jointings of underground electrical cables." Siemens Bros. & Co., W. Diesselhorst, and F. J. Budd. Dated June 23rd, 1900. Cases for joints, whether straight or multiple, are formed of two castings, which fit together and are fixed by bolts, and nuts are provided. 1 claim.

11,500. "Improvements in arc lamps." P. H. F. Spies. Dated June 25th, 1900. Relates to arc lamps. A clutch lamp is regulated by a shunt solenoid, which is carried on a tube connecting a top plate and a lower plate, and tends to draw down a tubular core carried by a sliding inner tube. The provisional specification states that an electro-magnet may be used instead of the solenoid. 4 claims.

11,504. "An improved process for fitting submarine cables for quick signalling." H. E. Kottler. Dated June 25th, 1900. Submarine cables for quick signalling have the armouring and sheathing wires interconnected at the joints, and completely insulated from the main conductor and lead sheathing. The armouring wires and lead sheathing are earthed at each end. 1 claim.

11,518. "Improvements in frogs to be used in connection with overhead conductors of electrical tramways and railways." H. C. Nicholson. Dated June 25th, 1900. Relates to electric railways and tramways with overhead conductors. Frogs for conductors. The tongue pivoted on the underside of the base is set for the main line or siding conductors, or is normally held on the main and set for the siding by the passing vehicle. As the vehicle runs on to a siding rail, the trolley head or pole strikes the spring arm carried by a bracket and arm on the tongue, and sets it for the conductor. A spring in a casing returns the tongue to the main line. An additional bracket and arm may be provided to prevent the tongue from returning before the trolley wheel leaves it. The outer end of the arm is curved, so as to be engaged by the trolley head, as the vehicle comes from the siding, in order to set the point to receive it. In the first-mentioned form, an arm is provided on both sides of the tongue to set it in either direction. 4 claims.

11,556. "Improvements in terminals and supports for Nernst lamp glowers." H. W. Hanks. Dated June 26th, 1900. Relates to incandescent lamps. An incandescence rod made of a mixture of rare earths by moulding, has metal beads embedded in its ends, which are preferably enlarged to receive connecting wires. For this purpose, the ends of the rod are first thickened by fusion in an arc, optionally first applying additional oxide paste, which may contain metal, or electrolytically depositing oxides on them. A bead of platinum, or an alloy of this with copper, nickel, iridium, or other metal, is then formed from a wire, on the end of the rod, in an oxyhydrogen flame, and the end heated in an arc until the metal bead sinks into its end. The bead is next fused by the oxyhydrogen flame sufficiently to receive the end of a connecting wire. 4 claims.

11,557. "Improvements in balance resistances and cut-outs for Nernst lamps." H. H. Potter. Dated June 26th, 1900. Incandescent oxide lamps, having auxiliary heaters, are provided with special steadying-resistances and cut-outs for the heaters, a number of forms of cut-out being specified; in some cases the heater is moved away from the incandescence body when this becomes conductive. The steadying-resistance consists of one or more straight iron wires in a glass vessel, which is exhausted of air or filled with hydrogen or other indifferent gas, the wire being heated nearly to redness when in use. The cut-out is in the same or a similar vessel. 18 claims.

11,558. "Improvements in systems of lighting by Nernst or like lamps." A. J. Warts. Dated June 26th, 1900. Relates to lighting by means of Nernst or like lamps, the object being to control the heaters, preferably from a central station. A simple arrangement of the lamps is described. The lamps being in parallel and connected to the mains, while the heaters are in series in a separate circuit supplied from a transformer. A switch controls the heating circuit. 16 claims.

11,559. "Improvements in starting apparatus for Nernst and like electric lamps." A. J. Warts and H. H. Potter. Dated June 26th, 1900. Starting apparatus and cut-outs for Nernst and like lamps. The heating circuit is obtained from a transformer, and is opened when the lamp is glowing. A solenoid is in series with the lamp, and its core normally closes the primary of the transformer. When the lamp is ignited the core is raised and the circuit broken. A balancing resistance may be arranged in the lamp circuit, or coil may form the resistance. 20 claims.

11,560. "Improvements in electric incandescent lamps." A. J. Warts and H. W. Hanks. Dated June 26th, 1900. Relates to incandescent lamps. Several incandescence rods are supported by wires and screws on a common terminal, and separate terminals on a porcelain plate. This is detachably connected by four terminals to a holder, and carries two grooved plates connected by dovetails, or made in one piece. Each terminal is connected to a separate steadying resistance consisting of coiled wire laid in two opposite grooves in the plate, and secured by enamel. The other ends of the resistances are all connected to one of the terminals. A preliminary heater consists of wire laid in the grooves on the plate just above the rods. 18 claims.

11,561. "Improvements in Nernst lamps and heaters therefor." A. J. Warts and H. H. Potter. Dated June 26th, 1900. Relates to incandescent lamps; supporting lamps. Auxiliary heaters for incandescent rods are made by winding fine platinum or other wire on thin transparent or other supports, made of powdered talc, soapstone, quartz, or glass, mixed with tragacanth, or other binding material, baked, and burnt at a high temperature. The support may be squirted into thin rod, wound with the wire, and curved to a helical form, or to open, conical or barrel forms, flat, zigzag, and then covered with more of the plastic material, which is subsequently baked. Connecting wires may be fixed diametrically through the ends of such tubes, while plastic, and the ends of the heating wires afterwards fused or otherwise secured to them. Such a tubular heater may be held between bosses on spring supports, connection being made by the support and a wire. The incandescence rod is carried on the same supports, using a glass ring and spring to permit movement at one end, connection being made through this and the supports. These parts and a globe-holder are carried on a cylinder containing a cut-out for the heater, and a steadying resistance, with a standard cap at the bottom. 22 claims.

11,562. "Improvements in and relating to electric lamps." P. C. Hewitt. Dated June 26th, 1900. Vacuum tubes. A tube for lighting contains vapour of mercury or lithium, or nitrogen or other gas at a pressure of a few millimetres of mercury. Selenium, phosphorus, sulphur, or red sulphide of mercury may be added to facilitate starting, which otherwise requires heating of the tube by a Bunsen burner or electrically. A high electric pressure must be used in either case, at starting. Afterwards the gas or vapour in the tube conducts a considerable current at ordinary supply pressures; for example, a current of several amperes in a tube $\frac{3}{4}$ in. in diameter, and 57 in. long., with 110 volts, gives an intense light. A steadying-resistance may be used in series with the tube. 21 claims.

11,584. "Improvements relating to incandescent electric lamps." C. Pantheier. Dated June 26th, 1900. (Date applied for under Sec. 103 of Patents, &c., Act, March 30th, 1883). Relates to incandescent lamps. Several lamps are mounted on an insulating plate provided with means for attachment to an ordinary holder. The lamps are connected in series or parallel as desired, so that, for instance, a group of low-pressure lamps may be used on a high-pressure circuit. The bulbs may be cylindrical, or may have flat surfaces to occupy less room. The flat surface may be enamelled white, or coloured, or silvered. The outer parts of the bulbs may be of coloured glass. The insulating plate may be extended to form a reflector, or may carry a separate reflector, and it may also carry a central reflector having flat wings situated between the lamps. 9 claims.

11,588. "Improvements in electric railways on the sectional conductor system." G. E. Kent. Dated June 26th, 1900. Electric railways and tramways on a sectional conductor system, with switches operated by magnets on the vehicle. The main conductor lies in the groove of the stringer, which may be made of two angle-sections secured to the sleepers by spurs on the angle pieces. The sectional exposed conductor is preferably thickened and raised along the centre, and embraces the top of the channel. Contact is made by the plunger with an iron head and pointed aluminium stem working in the mercury cup and lifted by magnets on the vehicle. A porcelain sleeve surrounds the mercury cup, and the space between these sleeves in the channel is filled in with wood. A carbon disc is placed on the top of the sleeve. The brushes for picking up the current are carried by pins in the forked ends of the pole-pieces of the magnets, and these brushes are preferably slotted in the centre for the lines of magnetic attraction to pass. 12 claims.

11,587. "Improvements in flexible conduits for electrical conductors." H. G. Osburn Hoboken. Dated June 26th, 1900. Flexible conduits are formed by interlacing single or double flexible helical strips with threads. A woven or braided cover may be externally applied. The helical strips may be of cane, metal, &c., and the threads may be cotton yarn, fine wire, &c. 1 claim.

11,609. "Improvements in means for protecting electrical apparatus from abrupt charges in static potential." P. H. Thomas. Dated June 26th, 1900. Relates to protective devices for electric circuits to prevent damage by excessive static potential. The leads of a system are connected by lighting arresters in series with impedances which are earthed. The arresters consist of a series of spark-gaps, of which one or more is or are shunted by impedances, and one or more is or are unshunted. One or more shunting impedances may be employed in each arrester. 2 claims.

11,610. "Improvements in means for protecting electrical apparatus from abrupt charges in static potential." P. H. Thomas. Dated June 26th, 1900. Relates to apparatus for protecting electric systems for static discharges, whether due to lightning or other causes. A system is described in which a generator has impedances in the leads, condensers, &c., one or more lightning arresters being bridged across the leads and connected to earth. The transformer is shown protected from the rise in potential due to opening the switches by means of impedances and condensers bridged across the leads and connected to the transformer core. In the case of direct current systems, only one side need be protected by the impedance and lightning arrester. 3 claims.

11,613. "Improvements in indicating and recording targets." G. McAlpine and G. L. McAlpine. Dated June 26th, 1900. When a bullet strikes the target, a metal ball is driven up parallel inclined electric conducting rails opposite to the point of impact by the vibration of the target, and an electric circuit is completed through an indicator and recording mechanism. On the cessation of the vibrations of the plate, the ball rolls back on to the non-conducting ends of the rails, and touches the back of the target. The target may be divided into a bull's-eye and concentric rings, and the rings may be divided radially into segments. 4 claims.

11,642. "Improved switch for lamp-holders." F. Rawlings. Dated June 27th, 1900. Switches for lamp-holders. The insulating base is fitted with the usual plungers, and the circuit is completed between the contact by contacts fitted on an insulating piece carried by an oscillating forked bar. The bar is operated by the cam or inclined plane turned by a handle. A roller is fitted on the bar to reduce friction, and a spring gives a quick break. The bar and handle are supported in a bridge piece secured to the base. 4 claims.

11,659. "An improved electric cut-out plug." M. Haase. (E. Roder.) Dated June 27th, 1900. Relates to means for indicating that a fuse has melted. The hollow space of the plug is filled with asbestos wool, or the like, which is blown out of a hole in the cap when the wire blows. A small ignition pellet is placed near the wire to blow out the wool when the wire melts slowly, the pellet igniting after a certain rise of temperature. 2 claims.

11,677. "Improvements relating to the parallel running of alternate current machinery." H. C. Lenke. Dated June 27th, 1900. Relates to the parallel running of alternate-current machines, such as alternators, motors, and rotary converters, and particularly to the automatic adjustment of the magnetic fields, so as to control periodic fluctuations in the angular velocity in the rotating parts, and also the value of the "wattless" current. 11 claims.

11,695. "Improvements in alternating current wattmeters." W. L. Wise. (Union Elektrizitäts-Gesellschaft, Berlin). Dated June 27th, 1900. Energy meters. An induction motor meter, for a single alternating current, has two or three straight electromagnets, placed parallel to the spindle, and driving two conduction-discs thereon. One electromagnet carries the main current, the other being connected between the mains, when two magnets are used; when three are used, the outer ones are connected alike. In order that the magnetic fields produced by the shunt current may be in quadrature with those produced by the main current, a bent wire or solid iron bar is fixed with its ends near those of the shunt electromagnet, the discs intervening. The bar is fixed in a sleeve after adjustment. An air gap may be provided in the bar. The ends of the bar may be formed as loops, as shown in plan. 2 claims.

11,727. "Improvements in electrical starting and regulating switches." A. H. Hickley. Dated June 29th, 1900 Starting and regulating switches are fitted with electromagnets below certain of the fixed contacts, and the switch arm carries iron armatures so that good contact may be obtained. 3 claims.

11,757. "Improvements in regulating devices for alternating electric current circuits." British Thomson-Houston Company. (E. Thomson). Dated June 29th, 1900. To obtain a constant current in transformer distribution, the coils are made relatively movable, but in order to simplify construction, the range of movement is limited. The range of load over which the coils have a relative movement depends upon circumstances, and may be near the maximum or minimum, or at an intermediate point. 5 claims.